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VOL. XIV. NEW YORK, OCT. 19, 1889. No. 16.

The Kemmler Decision. WE regret to report that the New York Electrical Execution law has been held constitutional by County Judge Day, before whom the case went, but we still hope to see the law declared unconstitutional or repealed. Not only is electricity a bad agent to employ for execution purposes, but in the present instance the law, even before being carried out, is under a cloud as having been made the means of attacking a great industry and one of the largest corporations engaged in it. The object of the philanthropist has not been reached, but the evil intentions of the quasi scientist aiming blows in the dark have been given their opportunity. The law as it stands is a disgrace to our State statute book, and should go.

Western Union Figures. THE summary given in another column of the annual report of the Western Union Telegraph Company shows that the corporation is in excellent shape. Perhaps its condition was never better, for although it has a larger capitalization than ever, it is practically without a serious rival in the field, and hence can operate economically while doing a larger business. This fact is seen in the lower cost of handling messages over the land lines, the figure now being 22.4 cents as compared with 23.2 cents last year. The average rate collected, 31.2 cents, was, however, the same. The productiveness of the plant and good will is exhibited in the payment of $4,309,520 in dividends and in the investment of over a million dollars in new property, including some railroad telegraph lines. Altogether the report is a bright one, and Western Union is likely to become an even dearer stock than it is now.

Electric Submarine Boats. THE facilities which electricity as a motive power affords in the way of compactness and ease of manipulation have revived the project of submarine navigation, and more than one inventor is striving to turn Jules Verne's "Nautilus" of fiction into reality. Prominent among these has been the Spanish officer Peral, the reports of whose work have for months past been passing through the press, though few, if any, details of value have been made public. The exact condition of affairs, however, is very well given by the article appearing on another page, in which Mr. Webb shows that there is still some work to be done before the "Peral" can be called a success. It is evident from the description of the mishaps encountered that the inventor is without sufficient electrical knowledge, and is hampered by the necessity of preserving his alleged secret, which precludes the calling in of a competent electrician to supervise the electrical equipment, which is the very soul of the whole apparatus. While this work is still in a tentative state we note the more successful trial of a submarine torpedo boat in New York Harbor, the details of which are given elsewhere in our columns. It will be observed that the movements of the vessel are controlled by a single wire, and a valuable improvement are the guide lights, which can be set aglow and extinguished at will. This gives the manipulator the power of directing the vessel at night without affording an enemy a mark upon which to fire. The other details are also of interest.

The Sawyer-Man Decision. VERY great interest attaches to the Sawyer-Man decision, which THE ELECTRICAL WORLD was the first paper to publish last week. Judge Bradley's decision, in which the broad claim of Sawyer-Man to the fibrous filament lamp is upset, invalidating the patent, is in many respects a remarkable one. "We are clearly of opinion," says the judge, "that neither Sawyer and Man nor Edison can maintain any just claim to the exclusive use of charcoal generally in any form as an incandescing conductor in an electric lamp." In fact, the two joint inventors did not start out with the idea of securing any such monopoly, he contends, but desired simply to patent the carbon arch; and he so reads the evidence as to intimate that an illegitimate effort was made when the subject matter was subsequently amended. But Judge Bradley is not satisfied with this, and goes on to define what the real invention in the practical, successful commercial incandescent lamp is, and this in a very plain way he describes as the filament of high resistance invented, perfected and patented by Mr. Edison. Of this he says, as Judge Wallace said of Reis in regard to the Bell telephone, "it is undoubtedly the great discovery in the art," without which "electric lighting would never have become a fact." This is clearing away the underbrush with a vengeance, and leaves to view, as never before, the giants of the forest. Judge Bradley's decision is, it must be frankly admitted, a very positive support to the Edison claims, and, if sustained in further litigation, might possibly create an Edison lamp monopoly in America of the kind already existing in England through the verdicts of the courts. But the question here arises as to the effect upon the Edison patents of the much-discussed foreign limitation. Should the rulings on that issue be sustained, the incandescent lamp is practically public property to-day; but if it be held on review that an American inventor should not be made to suffer in this manner, then Mr. Edison stands to win pretty well all along the line. Such is, in brief, the situation as the decision makes it.

Electric Railway Statistics. WE present in this issue a carefully compiled table, based upon original information supplied us by the local companies themselves, of the extent and capacity of the electrical railways of the country. As the table shows there are now running, or under contract, no fewer than 179 roads and extensions of roads in 127 towns and cities, operating 1,884 cars over 1,260.3 miles of track at the close of 1889, whereas at the close of 1885 there was practically but one electric road in America. The trackage to-day is enough to reach from New York to St. Louis, or to constitute a double-track road from one end of Great Britain to the other; and the rolling stock would carry as many passengers as that of any first class trunk line. The importance of these figures, as given in detail in our table, cannot be gainsaid or decried. It will be observed also that we have made an effort to secure definite information as to the cost of electric power. The returns have not been by any means as full as we could desire, and it is unreasonable to suppose that every manager is anxious to take the public into his confidence; but enough has been obtained to prove once again the great relative economy and efficiency of electricity. Some of the replies to our inquiries have been so interesting that we have been tempted to print a few of them, and they appear subjoined to the table. The day of the doubter has gone, and the most enthusiastic advocates of electricity are found among the street railway managers themselves. But all is not perfection yet, and we want to see more improvements, more inventions, more money invested in substantial work, more study of public convenience, more hearty belief in the future. In electric lighting there has been little but reconstruction and reconstruction, simply because those putting in the capital could not be convinced that their business would ever assume its present magnificent proportions; and, as our table itself shows, many of the street railway men have already made the mistake of underestimating their great opportunities, and the stability and reliability of their novel, but thoroughly scientific electric method; so that extensions are everywhere the order of the day.

Electrical Enterprise Abroad. THE AMERICAN in his travels abroad, aside from the antiquities which he encounters on every hand, finds comparatively little difference in the people and customs, especially in England, where, indeed, during the daylight he might often fancy himself at home, from the hospitable manner in which he is everywhere received. But the approach of night immediately recalls to him the fact that he is in a foreign land, in which progress in any new direction is slow. We need only cite the correspondence appearing in another column, in which the condition of electric lighting in a few of the leading cities in England is portrayed. It is true that London will shortly be in the front rank of cities possessing electric distribution systems, and one or two other towns are getting under way for active work; but when compared with the general application in America, electrical engineering work has hardly begun in England, where, on account of the density of population and cheapness of fuel, all the conditions seem to be favorable. Arc lighting especially is notably absent, and even in London, where a number of incandescent light stations are in operation and in course of construction, no regular arc light station is yet to be found, the few lights running being fed from private plants. What has just been said of electric lighting is even more applicable to electric power distribution, for which the opportunities presented in many districts are so brilliant. The reasons for this backward state of the art are partly given in the correspondence, but may be traced more clearly to two prime causes, viz., the low price of gas and the fact that the underground running of wires carrying heavy currents is generally insisted on. The first of these difficulties, if it may be so termed, is one which in itself is no bar to the successful operation of electric plants, involving as it does also cheap coal for the operation of the station. But its principal effect is felt in the reluctance of consumers to change the old method of illumination for one which the public abroad still imagine to be in an experimental state; so that any investment for wiring or fixtures may turn out to be a total loss. If to this we add the fact, as above mentioned, that the wires, even in the smallest towns, are required to be run underground, the reason for much of England's backwardness is reached.

The New York Subway Situation. THE report in our issue this week of the proceedings of the Subway Board reveals a crisis in the conditions affecting arc lighting in this city. Mayor Grant, in his anger, real or assumed, dominates the scene, and though in various quarters it is asserted that he agitates the matter solely to enable his subway friends to derive an income from their "moisture pipes," we think he should be given credit for a resolve to do his duty. Even then, however, it is a pity he is not better informed in the premises, because his energy would thus yield good results. All the hectoring in the world will not help things, either in the way of keeping gas and water out of the subway ducts or of bettering the insulation of overhead wires. Dr. Wheeler's position and statements in this respect are perfectly sensible and true, and it is a pity that so competent and faithful an officer does not get more support of the right kind from his superiors. In spite of all the tumult and agitation on the subject, we see no reason for changing the opinion expressed on this page in our issue of Sept. 28, as follows: "A few accidents have been reported lately as resulting from contact with the arc-light wires running overhead through the streets of this city. As usual, the stories have been most wildly exaggerated. Still, there is a substratum of truth, and it may not, therefore, be amiss to make passing note of the situation. The fact probably is that the recent severe and long-continued wet weather has tested the wires pretty thoroughly and found out their weak places. The wonder to us is that some of the circuits show up as well as they do and are not more troublesome. Their insulation in wet weather was low to begin with, and now that they have been up so long their liability to leakage and short circuit daily becomes more pronounced and evident. In view of the fact that there are now on the market excellent brands of overhead insulated wire of high insulation and great durability, such as were unobtainable in the early days of the industry, it would be prudent for the local companies to renovate their circuits wherever necessary. To do so would 'pay.'" That holds good now, but it might be added that the companies in fault are at least entitled to a chance to renew and renovate their circuits when they want to do so; and that when men are provided with rubber gloves for handling the wires, it is rather too much to blame the companies if some poor heedless lineman goes to his self-inflicted death with his hands bare and his sleeves rolled up.

The Zipernowsky Electrostatic Motor.

The well-known phenomenon that bodies charged with identical electricity repel each other, was first used in 1780 by Franklin for the production of continuous motion. He employed a horizontal wheel constructed of horizontal strips of glass fitted at each end with copper balls. The wheel was placed upon a point between the balls of two Leyden jars with opposite charges, so that two diametrical balls of the wheel became charged similarly to those of the jars and were consequently repelled by the latter. After a revolution of 180 degrees, each ball discharged itself on the ball of the opposite Leyden jar, receiving at

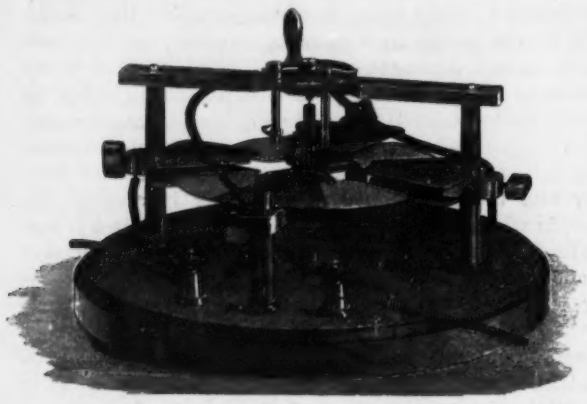


Fig. 1.—The Zipernowsky Electrostatic Motor.

the same time a part of the electricity there accumulated, and was repelled. Franklin named this apparatus an electrical kitchen jack.

Poggendorff subsequently showed that a movable disc of glass or ebonite begins to rotate if opposite electricities are conveyed to it by means of two diametrically opposite combs, and if at the same time it receives an initial impulse in any direction.

Poggendorff also set a Holtz influence machine in rotation by charging the combs of this machine by another influence machine.

In order to study the so-called static effects of high tension alternating currents, Herr Zipernowsky, among others, has constructed a small rotary apparatus which he derived from Thomson's quadrant electrometer in the idiostatic form indicated by Joubert. Zipernowsky, says the London *Electrical Review*, has been able to set this apparatus in rapid motion both with a high tension alternating current and with a high tension continuous current. In the former case he introduced the apparatus between the secondary terminals of a transformer whose primary was connected to an alternating current machine of low tension. With 1,000 volts the rotation was so rapid that it could not be followed with the eye.

In the second case he took the electricity from a driving band which connects the shafting in the testing room of the electrotechnical department of Ganz & Co.'s establishment with the motor, a high-speed steam engine. In this case the number of rotations was much greater than with a 2,000-volt alternating current.

Fig. 1 gives a perspective view of this small motor, and Fig. 2 a diagrammatic representation, with the arrange-

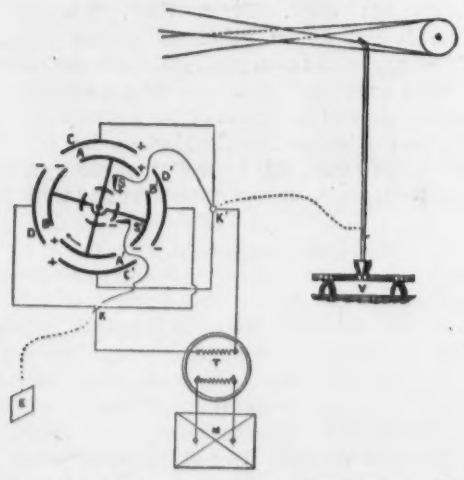


Fig. 2.—The Zipernowsky Electrostatic Motor.

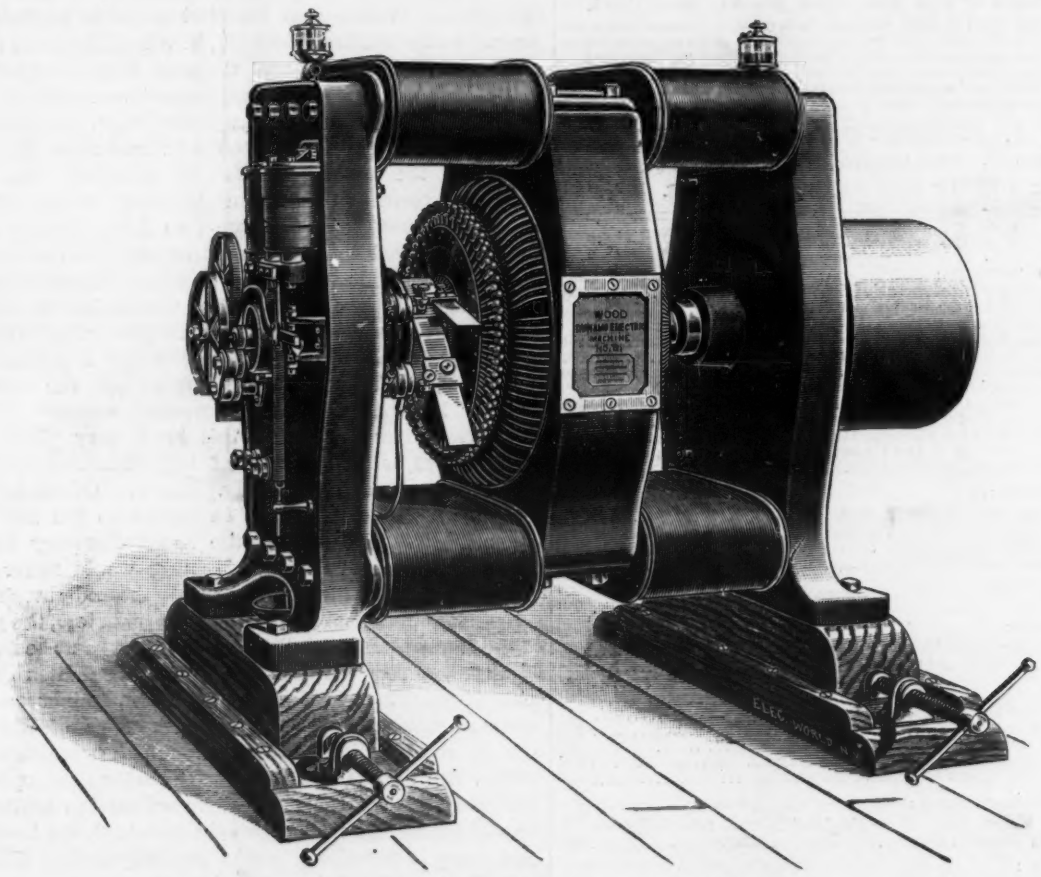
ment of connections shown in both the cases. The movable part of the apparatus consists of two pairs of aluminium sectors, insulated from each other, which, for the sake of perspicuity, are represented in Fig. 2 as the quadrants *A A'*, *B B'*. The fixed part consists of four double (hollow) sectors of brass, which inclose the movable sectors, and which are also shown in the diagram as the quadrants *C C'*, *D D'*. The movable part is further fitted with a commutator in four parts, by means of which the two pairs of sectors *A A'* and *B B'* are charged identically with the opposite fixed pairs of sectors by means of the points *S S'*. If the clamps *K K'* are connected with the terminals *S S'* of the transformer *T*, which converts the low tension of the alternating current machine *M* into a high tension, the apparatus begins to revolve spontaneously unless the movable sectors are placed exactly opposite to the fixed ones. The same takes place if one clamp is connected with the receiving device *V*, and the other is connected with the earth. It must be remarked that in this second arrangement a momentary charge of the movable sectors would suffice, as the fixed segments do not alter the sign of their charge. In the former arrangement the charge must be continued, so that the electricities in the fixed and the movable parts may change their signs simultaneously.

It is possible that this apparatus, in some form or other, will be suitable for practical purposes, *e. g.*, as a volt-counter for arc lamps in series, as a registering apparatus for the resistance of earth connections, or for changes in the primary tension in alternating current circuits, and perhaps in the case of very high tensions as a motor.

The New Wood Arc Light System.

One of the first to enter the field of arc lighting in this country was Mr. James J. Wood, and his machine is, no doubt, well known to most of our readers, the original machine, together with successive improvements, having been described at various times in the columns of this journal. During the past few months Mr. Wood has been busy on a thorough remodeling of his system, which is now built by the Fort Wayne Electric Company, of this city. The accompanying illustration shows the new machine, which, though it resembles in its general appearance the older form of the Wood dynamo, nevertheless contains a large number of changes, which, it is claimed, increase its efficiency and reliability in many ways.

Chief among the improvements which have been brought about are those relating to the automatic regulator, by means of which the brushes are shifted to maintain the current normal, whatever be the number of lights on the circuit. In order to accomplish this, Mr. Wood employs



THE NEW WOOD ARC LIGHT DYNAMO.

two sets of brushes, each positive and negative pair being so arranged as to span a certain number of the commutator sections, by which means that number of sections of the armature is short-circuited. In the 60-light machine, shown in the accompanying illustration, the arrangement is such that at full load the individual brushes span five sections of the armature, while, when the machine is running with but a single lamp, the brushes of the same denomination span 12 sections of the commutator and short-circuit a corresponding number of the armature sections.

The principle upon which this method of regulation depends is based upon the fact, which Mr. Wood has verified by experiment, that the commutation takes place in a magnetic field of varying strength, according to the load on the machine. Thus with a full load the commutation takes place in a strong field, so that with the five sections above alluded to as short-circuited, a sufficient counter electromotive force is introduced to avoid all sparking, while, when a small load is placed upon the machine, the point of commutation is in a weak field, which necessitates the use of twelve sections in order to avoid the sparking.

The introduction of these idle sections in the armature does not involve a waste of energy, but only an armature having a few more sections of wire upon it than would be called for by the electromotive force which the machine is required to develop. It might also be argued that the short-circuiting of these coils would cause a heating effect but this is found not to be the case, the armature running perfectly cool. Indeed, actual tests have shown that in passing the neutral point from positive to negative flow, the counter electromotive force developed in these short-circuited coils is sufficient to cut down the current passing in them to almost nothing, so that no heating takes place.

The brushes are mounted upon two separate yokes, and the distance between them is automatically regulated by means of two gear wheels which are connected to the regulator shaft, but which are of different pitch, so that the same revolution of the regulator shaft causes one set of brushes to move away from the other in proportion to the number of sections required for the load on the machine.

Coming to the improvements in the regulating mechanism itself, we find that the cores of the regulating solenoid at the side of the machine, instead of being solid bars of iron are split along their entire length. This construction makes the solenoid far more sensitive than those of the ordinary form with solid cores, and this is shown by the fact that the core and its cross bar are in a continual state of vibration, ready to respond to the slightest change in the current strength. The sensitiveness of the split core is evidently due to the fact that contiguous ends of both are of the same polarity, and therefore in such a state as to be easily affected by a change in the magnetizing current. The construction also entirely avoids the residual magnetism always to be found in solid cores and which makes them sluggish in their action.

The regulator, although still acting upon the same principle of friction wheels, which are brought into contact so as to shift the brushes with any change in load, has been entirely remodeled, and so improved that the machine can be put to the most severe tests without failure or interruption of service. In the new machine the gear wheel which transmits motion to the yokes carrying the brushes, is carried on the shaft by a clutch coupling of very ingenious form, so that the instant the brushes have reached either their maximum or minimum position, the clutch is thrown out of action and the yokes are stopped in their movement, and remain in their final positions. By inserting a small catch, also, the regulator, when the machine is operating normally, is entirely stopped in its movement, but any change in the current due to a change on the circuit immediately starts the motion and rectifies the current.

Besides the improvement in the electrical arrangement, the machine has been entirely overhauled mechanically, and by means of special bearings and oiling arrangements, overheating is entirely avoided and all spattering of oil prevented. During a recent visit to the workshops of the Fort Wayne Electric Company, we witnessed a test such as is rarely seen or experienced even in actual practice. Two machines, a 60 lighter and a 45 lighter, were coupled in series and overloaded until 123 lamps were burning on the circuit. Various tests were made, but the crowning one was that in which the entire 123 lamps were short-circuited instantly. In less than one second the brushes had come around, and with comparatively little spark the machines resumed their normal current. Under normal operation the sparking observed under the brushes is almost nil, that which does appear being quite similar to that seen under the brushes of an incandescent machine at times, being a small, quiet spark, without any of the characteristics of that usually noted in connection with arc machines. Mr. Wood has also entirely remodeled both his single and double arc lamp, which now contains a far less number of parts than the older form. Both the new machine and the lamp, together with other improvements in the details of Mr. Wood's system, will not fail to attract the attention of those interested in the improvement of arc light machinery.

The Exhibit of the American Bell Telephone Company and the Western Electric Company at the Paris Exposition.

Whatever reason exists for the many complaints made by whole-souled and patriotic Americans, of the meagre figure cut by our exhibitors, not only as representing the dignity of our position in the world of commerce and manufactures, but also in the various entertainments and other functions offered by our hospitable friends, the French, there are undoubtedly a few displays which for scope and elegance of appointment are second to none in the entire exhibition. It is difficult to praise too highly the patriotism and honorable feeling of the directors of the American Bell Telephone Company and the Western Electric Company, who, without much, if any, prospect of other than purely sentimental advantage, have come to the rescue in such a liberal and generous manner and done so much to raise the United States section from the mediocrity to which the lack of energy or knowledge in certain quarters, has certainly exposed it.

The space occupied by these exhibitors is one of the best in the section, and it has been well utilized. The accompanying engravings, Figs. 1 and 2, show the exhibit as looked at from the Russian section and from the side of the main aisle of the United States section respectively. It contains a series of photographs of all our principal telephone exchanges, with views of both underground and overhead line construction, while the apparatus and material generally in use with us, and manufactured by these companies, has commanded a great deal of interest among our Gallic friends; and the exhibit has, as the visitors' book shows, been visited by the leading electricians not only of France, but of all Europe, and it is not too much to say, has commanded their admiration, if not envy. What seems to have struck the foreign admirers most forcibly, is the manner in which we save time and, consequently, secure better and more economical service, by cutting down all the reglementary and useless forms which impede both the adoption and the application of the telephone in Europe. They seem astonished that a science whose application is with them so religiously surrounded by innumerable safeguards against so many purely imaginary abuses, is with us reduced to a matter of the commonest familiarity. In a word, this exhibit has shown them that instead of hampering the application of telephonic industry with lots of rules and formalities to provide for contingencies which never occur, and with us never could occur, much of our success is due to the fact that we make no rules that are not absolutely required, and leave the most suitable and natural way of doing work to the reasoning powers of the users and their desire for speed. To the average telephone man a look into a French telephone exchange with the old-fashioned board, and the operators holding their transmitters with one hand, while they hold quite a polite conversation with the subscriber to find out what they are to do with the other, fills him with astonishment that the lines are ever used at all, and with admiration at the steady patience which allows them all to wait patiently for thrice as many minutes as it would require seconds with a multiple board.

The switch-board seen in the middle of the exhibit connects all quarters of the exposition with the main office of the United States Commission, and shows to great advantage the clear and loud-speaking qualities of the apparatus used by the Long Distance Telephone Company. One-half of one of this company's 80-foot poles occupies the centre of the exhibit and its base terminates in a beautiful bed of flowers and graceful palms. The large presentation life size portrait in oil of Prof. Alexander Graham Bell, which occupies the angle of the room, is by the celebrated French artist Lobrichon, and is valued at $5,000.

In the show-cases are arranged many objects of interest, notably a historic exhibit of the various forms of telephone which led to the adoption of the present one, as well as a set of Patterson cables with conductors numbering from one conductor for arc lights to one with 250 conductors for telephone work. These have caused much inquiry and admiration from European electricians. With them also are some specimens showing how these cables are spliced, and it is not too much to say that they are fully equal, if not superior, to European work of this kind.

The style in which the whole exhibit is arranged is most tasteful and artistic, and is in most favorable contrast with the gaudy and meretricious style of decoration and arrangement which usually prevails so obtrusively at exhibitions. Altogether it is a credit to the United States generally, and we trust that the companies will reap the reward their enterprise and the liberal help they have given to the U. S. Commission deserves.

The exhibit as a whole was entrusted to Mr. W. D. Sargent, the well-known manager of the New York & New Jersey Telephone Company, whose coadjutor, Mr. J. D. Bishop, preceded him and is now in charge there. Mr. J. J. Stone is electrician of the exchange, which gives first-class service. The exhibit under notice is another proof that the terms, "Sargent" and "Success," are synonymous.

FIG. 1.—EXHIBIT OF THE AMERICAN BELL AND WESTERN ELECTRIC COMPANIES PARIS EXPOSITION.

The Peral Submarine Torpedo Boat.

BY HERBERT LAWS WEBB.

A vast amount of mystery surrounds the new Spanish submarine boat, which, if we are to believe all that the Spanish papers tell us, is to revolutionize naval warfare and enable Spain to reassume the supremacy of the seas and once more take a prominent place among the great powers. The newspaper press of Spain has for nearly a year written Peral and his invention up to the topmost heights of fame; he is the most wonderful man of the age, the greatest benefactor of his race and country ever born; Newton, Faraday and Franklin are names not to be mentioned in the same breath with that of Peral; the whole world is anxiously looking to Spain and Peral for a solution of one of the greatest problems of the age; and a great deal more in the same strain.

So far Spain and Peral do not seem to have been able to show the whole world that very much has been done toward making a success of submarine navigation, and the only result of the trials made up to early last month, according to advices received from Cadiz, seems to be that Peral has succeeded in constructing an electric launch of a peculiar shape, in which he has made a few short trips *on the surface* of the Bay of Cadiz. The entire history of the "Peral" is one of vicissitudes. It was only after innumerable delays and difficulties that Peral succeeded in convincing the naval authorities of the practicability of his plans. Finally an appropriation was granted—it is said that the Queen Regent contributed the whole or a part of the necessary funds from her privy purse—and the work of construction was begun at the naval arsenal at San Fernando, near Cadiz.

The hull of the "Peral" is built of steel plates, and measures about 60 feet long by 6 feet beam and 8 feet deep. Like other types of submarine boats, it is cylinder-shaped

with pointed ends, a small deck being provided for use when navigating on the surface. From the centre of the deck projects a conning-tower fitted with glass sides; in this conning-tower are placed switches and apparatus for controlling the various motors and telephones, in connection with the posts of the crew of the boat, so that Lieut. Peral, when once his vessel is fairly submerged, will be able from this conning-tower to observe all that is going on around him outside the boat and communicate his orders to his subordinates, directing with his own hands the more important manœuvres much in the same way as the captain of a floating war vessel.

The whole of the machinery of the "Peral" is worked by electricity, the energy being supplied from a battery of 800 E. P. S. cells, said to be the largest battery of accumulators in existence. There are two propellers, each one driven by a 20 h. p. Immisch motor. The horizontal propellers for submerging and raising the vessel, and the apparatus for supplying compressed air to renew the atmosphere when the vessel is submerged, are run by electric motors, and the vessel is lighted by incandescent lamps, current for all of which is supplied by the 800 accumulators. The technical details are meagre and incomplete, and although so much unnecessary and premature publicity has been given to the different stages of construction and the preliminary trials, all information of a technical character has been studiously withheld, and Peral's secret—if he has one, which has yet to be proved—has naturally been most carefully guarded.

The crew of the "Peral" consists of the designer and four assistants, all four being naval officers, who are supposed to have received a certain amount of instruction in electricity and torpedo practice. The first difficulties met with, when the boat was nearing completion and the installation of the electrical machinery and batteries had to be proceeded with, were due to the lack of experience of these gentlemen in handling such gear. Numerous minor accidents occurred during the charging of the accumulators and placing them on board. In December last all was announced ready for the first trials, and all Spain was in a fever of excitement. Official representatives of the Queen Regent and of the Minister of Marine were sent to witness the trials, and reporters for the Madrid papers flocked to Cadiz. Months passed and nothing happened. The naval authorities and the reporters went back to Madrid and waited for further developments. Finally, about the end of February, it was discovered that the "Peral" would float, and this simple fact aroused immense enthusiasm, notwithstanding that the object to be attained was, and still is, that it should *sink*. A few days later the "Peral" sailed forth from the dock to which operations had hitherto been confined, and almost immediately afterward ran aground on a sand bank, owing to the failure of the steering gear. Trial number two resulted in the burning up of one of the principal motors. The damaged armature was packed off to London under care of one of the officers of the boat, the papers gave out that the machinery had failed owing to faulty construction; operations were suspended, and the Peral fever subsided for a time. Within the last few months it has broken out with renewed virulence. A new armature was sent out in due course, and trials were recommenced with more caution than before. Apparently the talented staff of the "Peral" are becoming more accustomed to the handling of their batteries, switches and motors, as no more accidents of importance are recorded. For some time the trials were conducted in strict secrecy in one of the docks of the arsenal, all operations being carried on at night, when the operatives had quitted work. Absolutely nobody was allowed to be present except Peral and his assistants. and the number of these has been diminished by one—a gentleman who, during the early days of the Peral fever, showed an insatiable desire for rushing into print with astonishing prophecies of the results to be achieved. At these secret trials we are assured that the capabilities of the "Peral" to sink and rise at will were abundantly proved, but so far these assurances have not been backed up by any public or even semi-public demonstration. The latest public trials of which reliable news has been received took place in Cadiz Bay, late in August and during the first week of September. They were restricted to evolutions afloat and the discharge of torpedoes. Even yet the "Peral" does not seem to be entirely under the control of her navigators, as upon one of these occasions the vessel ran aground immediately after leaving the dock. Several unsuccessful attempts were made by small steamers to tow her off, and finally a powerful tug came to the rescue and got the "Peral" afloat just before darkness came on. On the following day the "Peral" made a trip round Cadiz Bay, followed by an admiring procession of small steamers, launches and other craft. The evolutions performed were confined to cruising about, always on the surface, describing circles and discharging torpedoes. As a torpedo boat the "Peral" does not seem to be a phenomenal success. Three torpedoes were discharged. The first brought up at a distance of about 500 yards, the second at 400 and the third at 50. Even the furthest distance seems rather short range for a torpedo boat, but it is not stated whether Peral was making a real demonstration of the powers of his invention, or merely "playing to the gallery," a branch of demonstration in which he appears to be an adept, and certainly it must be admitted that he has so far met with unstinted measures of applause.

The above sketch of the history of the "Peral" in a measure reports progress up to the present, and it is apparent that although the boat has been completed for about eight months, we still remain in utter ignorance as to whether Peral has really solved, or even made any approach toward solving, the problem of submarine navigation. If he has made any material steps toward that end, nobody will begrudge to him the fame which will be justly his due, or to Spain the honor of producing a scientific investigator capable of achieving practical results. However, until material proof is afforded that something has actually been accomplished, the Spanish papers are only rendering themselves, their country and Peral ridiculous in the eyes of the rest of the world by their extravagant praise of the invention and the inventor, and their wild speculations as to a forthcoming revolution in naval warfare.—*Cosas de España*, one may say.

FIG. 2.—EXHIBIT OF THE AMERICAN BELL AND WESTERN ELECTRIC COMPANIES, PARIS EXPOSITION.

The Halpine Electric Submarine Torpedo Boat.

It is well known that until long after the close of the civil war American inventors continued to puzzle their brains and spend large sums of money in the endeavor to construct torpedoes that would be effective against any possible attack by a foreign naval power. It was found that to successfully attack a heavily-armored war ship by this method, it was necessary to explode the torpedo beneath the water line and in close proximity to the vessel. To guard against this, vessels were provided with strong nets of hemp, which were hung around and at some distance from the hull. This afforded reasonable protection until devices appeared by means of which the nets

could be cut and broken, after which they were made of steel instead of hemp.

When the steel nets were adopted, the torpedo advocates relied upon a larger charge of explosives, which was fired outside of the net; but this was not altogether satisfactory, and the ordinary form of torpedo could not be used to advantage, owing to the fact that the explosion destroyed not only the enemy's vessel, but the craft carrying the torpedo as well, thus rendering practice well nigh impossible, for each discharge involved the total destruction of apparatus costing from two to five thousand dollars.

After a careful consideration of these and other defects in existing apparatus, Lieut. Nicholas J. Halpine, a promising officer of the United States Navy, became convinced that the most practicable plan was to use a submarine boat which would deliver an explosive charge to a point beneath the keel of the enemy's vessel, and then automatically back off to a safe distance before the explosion occurred, so that it could be used over and over again both in practice and in actual warfare.

The problem of how to propel such a craft under water and control it from the shore or from another ship, as well as to automatically deliver and fire the torpedo, was found, as will be readily believed, a difficult one to solve. Just as Lieutenant Halpine's plans were about to materialize he received orders to join the U. S. S. "Tallapoosa" in South American waters, and it was therefore decided to place the development of the apparatus in the hands of Mr. Arthur W. Savage, the inventor of improved small arms. The successful operation of the first boat built reflects great credit on Mr. Savage, and proves him to be an inventor of a high order. In the designing of the electrical apparatus he was assisted materially by Mr. Frank A. Perret, of Brooklyn, N. Y., whose abilities as an electrician are well known.

The present apparatus was built at the Adriance Machine Works, Brooklyn, N. Y., under Mr. Savage's immediate supervision. It was decided to propel the boat by an electric motor and storage batteries. The Perret motor, manufactured by the Elektron Manufacturing Company, of Brooklyn, was adopted, as being peculiarly adapted to the work by reason of its high efficiency and light weight in proportion to power developed. The River and Rail storage battery is used.

The motor is connected direct to the shaft of the propeller, which is of the Bartlett pattern, and was designed especially for the work, being cast in phosphor bronze and having three blades. It will be seen by the accompanying illustration that the boat proper consists of a large metallic cylinder, pointed at both ends, in which the motor and battery are contained. The weight of these is calculated and disposed so that the boat is kept at proper depth and position in the water. A case containing a powerful charge of explosive is carried in a pocket on the under side of the boat, well forward, and is connected with the harpoon by a chain, as shown. When the harpoon strikes anything it attaches itself thereto, and at the same time the case of explosive is forced forward out of the pocket.

The boat is kept under the control of an operator on shore or on a ship, by means of special electrical mechanism on the boat, connected by a single insulated wire with switching mechanism and a portable battery at the operator's position. The connecting wire is carried by a reel in the torpedo boat, which pays it out as the boat goes forward. The return circuit is made by the water.

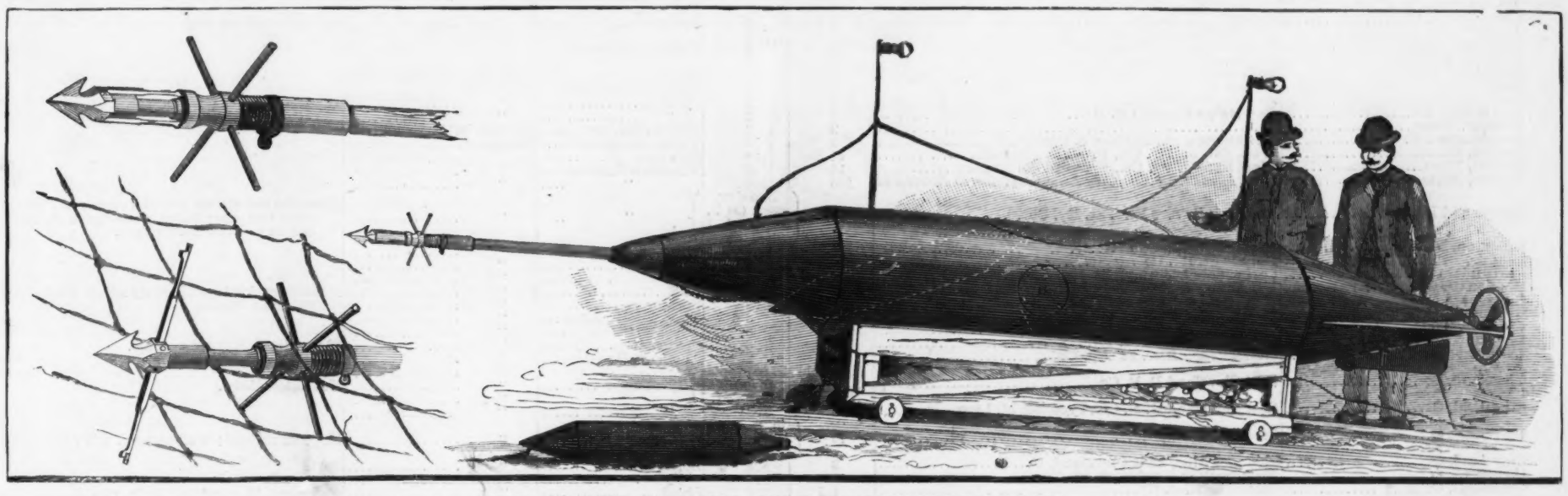
By means of the mechanism mentioned, together with an ingenious system of relays and currents of varying intensity, the operator may at will cause the torpedo boat to go ahead, stop, go astern, steer a straight course, steer to port or steer to starboard, and cause the guide lights to flash. It is quite remarkable that all these operations are conducted over a single wire. In the experiments made recently near Bay Ridge, in New York Harbor, this wire was one and one-half miles long. By the use of more powerful batteries the distance may be increased to three or four miles.

It is intended that in actual warfare the boat shall run a few feet below the surface of the water to protect it from the enemy's shots. Two small staffs will project above the surface and carry red and green electric lights, which may be flashed at the will of the operator, and enable him to determine the position and direction of the craft at any time.

When the prow or harpoon of the torpedo boat strikes the vessel that it is sought to destroy, or the net surrounding the vessel, it attaches itself thereto, together with the case containing the explosive, and a time-fuse is ignited. At the same time the motor is automatically reversed and the boat backs to a place of safety, from whence it may be guided to the operating station. All these operations were successfully performed at the recent trial.

The reel of wire is so designed that when the boat returns from an attack to receive a fresh charge of explosive, a fresh-wound reel can be instantly substituted for the one that has been unwound, thus placing the boat in readiness for an immediate attack.

The speed of the present boat is about eleven knots an hour. It is intended to put in more power and the inventor hopes eventually to attain a speed of twenty-five knots an hour.



THE HALPINE ELECTRIC SUBMARINE TORPEDO BOAT.

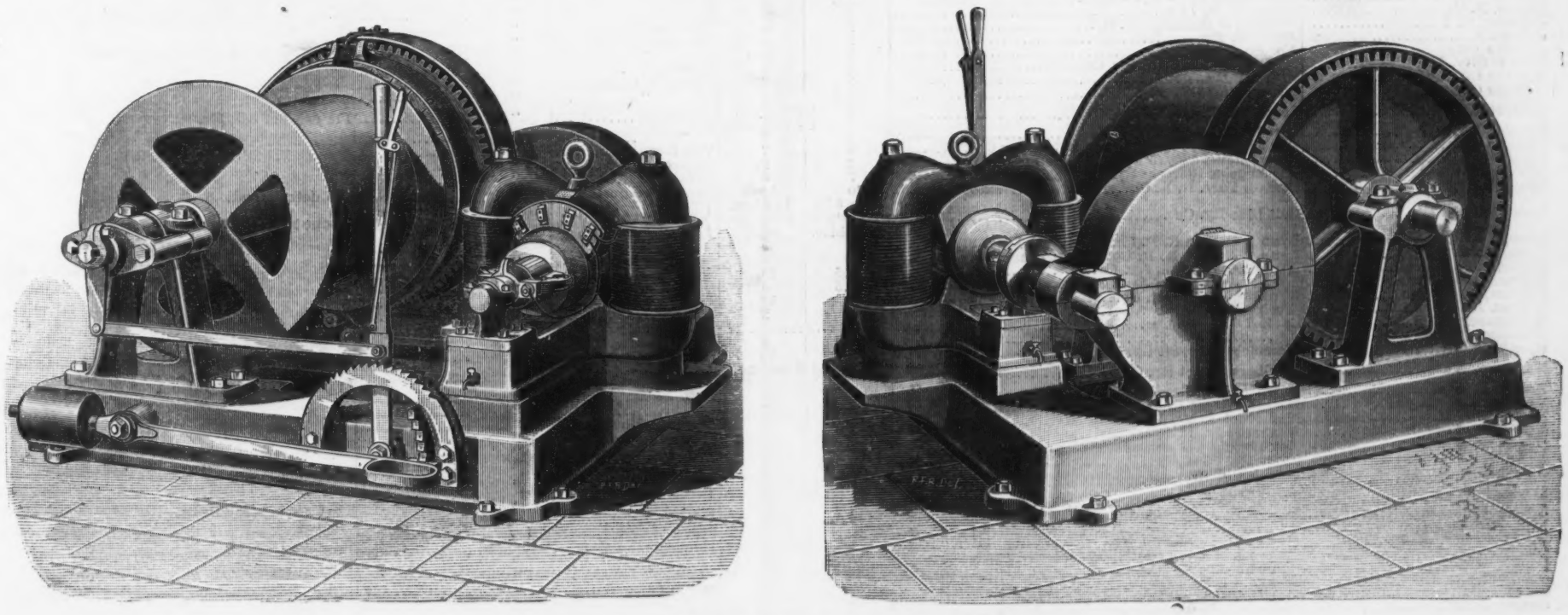
New Sprague Mining Hoist.

We present in this issue two views of an improved electric mining hoist, which has recently been built by the Sprague Electric Railway and Motor Company of this city for electric mining work.

The general arrangement of the different parts will be readily understood from the accompanying illustrations.

The gears, it will be noted, are all boxed in iron cases to protect them from dust or stray stones. At the same time these cases can be quickly removed if occasion should demand the uncovering of the working parts. Every part of the machine is designed to give the greatest power with the least weight, and by this means the machine is made quite light and can be easily transported from one part of the mine premises to another.

The qualities of durability, compactness, ease of operation and minimum of wear, so essential in mining work, have been carefully attended to in this machine. The illustrations show that no extra room is taken up by any part of the apparatus. Everything is arranged to fit closely upon the base frame of the hoist.



FIGS. 1 AND 2.—NEW SPRAGUE ELECTRIC MINING HOIST.

The speed of the motor is controlled by a regular Sprague switch on one side, by means of which the motor can be made to vary its speed by a single movement of the switch handle. Turning the handle to one division will make the motor run slowly; through two divisions faster; and when on the full number of divisions at full speed; while by turning the handle in the opposite direction corresponding rates of speed in the opposite direction of rotation are effected.

This electric hoist must prove a valuable adjunct in mining and mill work, where a convenient and portable hoist which can be operated from the lighting circuit already installed has long been needed. We may add that this is only one of a number of mining appliances brought out, or in process of construction, by the Sprague Company.

"THE ELECTRICAL WORLD" TABLE OF AMERICAN ELECTRIC STREET RAILWAYS, OCTOBER, 1889.

LOCATION.	Road.	Length of track in miles.	No. of cars.	System.	Method.	Cost of operation and remarks.
Adrian, Mich	*Adrian Electric Railway*	3	....	Nat. Elec. Trac. Co.	Overhead	
Adrian, Mich	*Adrian City Belt Line Elec. Ry. Co*	3	4	Rae	"	
Akron, O	*Akron Elec. Ry. Co*	6	22	Sprague	"	
Akron, O	Akron Elec. Ry. Co	7	16	"	"	
Akron, O	South Side Extension	6	10	"	"	
Albany, N. Y	Watervliet Turnpike & Ry. Co	22.75	16 motors 38 tr'l. cars	Thomson-Houston	"	
Allegheny, Pa	Observatory Hill Pass. Ry. Co	4	6	Bentley-Knight	3 m. overh'd; 1 m. cond't.	
Alliance, O	Alliance Street Ry. Co	2	3	Thomson-Houston	Overhead	Not determined; well pleased with the system.
Americus, Ga	*Americus St. Ry. Co*	5.5	4	"	"	
Ansonia, Conn	Derby Street Ry. Co	4	5	"	"	Not determined.
Atlanta, Ga	Fulton Co. St. Ry. Co	9	8	"	"	
Atlanta, Ga	Atlanta & Edgewood St. Ry. Co	4.5	4	"	"	
Appleton, Wis	Appleton Electric St. Ry. Co	4.5	5	Van Depoele	"	
Asbury Park, N. J	Seashore Electric Ry. Co	4	20	Daft	"	
Asheville, N. C	Asheville St. Ry. Co	4.5	5	Sprague	"	$2.50 per day per car.
Atlantic City, N. J	Pennsylvania R. R. Co	6.5	6	"	"	
Attleboro, Mass	No. Attleboro & Wrentham St. Ry	8	5	Thomson-Houston	"	
Auburn, N. Y	*Auburn Electric Ry. Co*	3	3	"	"	
Baltimore, Md	Baltimore Union Pass. Ry. Co	2	4	Daft	Overh'd and surface con.	
Bangor, Me	Bangor St. Ry. Co	5	4	Thomson-Houston	Overhead	
Bay City, Mich	Bay City Railroad Co	5	3	Sprague	"	
Bay Ridge, Md	Bay Ridge Electric R. R	2	2	"		
Beverly, Mass		3	2	Union Elec. Car Co.	Storage battery	
Binghamton, N. Y	Washington St., Asylum & Park R. R.	5	15	Thomson-Houston	Overhead	
Boston, Mass	West End St. Ry. Co., Brookline Branch	11	23	Sprague	"	
Boston, Mass	West End St. Ry. Co., Harvard Sq. Branch	14	20	Thomson-Houston	"	
Boston, Mass	*West End St. Ry.Co.,City Line, Boylston & Beacon St*	230	300	"	"	
Boston and Revere	Boston & Revere Elec. St. Ry. Co	4.3	5 motor cars (30 h. p. each), 7 open cars.	"	"	About $6 per motor per 90 miles run; $1 extra for a tow car; 10,780 passengers carried in one day with 5 motor cars.
Brockton, Mass	East Side St. Ry. Co	4.75	4	Sprague	"	
Buffalo, N. Y	Buffalo St. Ry. Co	2.5	4	"	"	
Carbondale, Pa	Carbondale & Jermyn St. Ry	1.5	3	"	"	
Cincinnati, O	Mt. Adams & Eden Park Inclined Ry. Co	1	3	Daft	"	Not determined; will equip Eden Park line in the near future.
Cincinnati, O	Cincinnati & Inclined Plane Ry	6	20	Sprague	"	
Cincinnati, O	Consolidated Street Railroad Co	2.8	8	Thomson-Houston	"	
Cincinnati, O	*Cincinnati St. Ry. Co*	2.7	8	"	"	
Chattanooga, Tenn	Chattanooga Elec. St. Ry. Co	6	8	Sprague	"	$2 per day. A great success.
Chattanooga, Tenn	*Chattanooga Elec. St. Ry. Co*	....	2	Thomson-Houston	"	
Cleveland, O	East Cleveland R. R. Co	12 double 8 single track.	30 equipp'd 30 more ordered	Sprague	"	Not determined.
Cleveland, O	East Cleveland R. R. Co., Prospect St. Line	5	32	"	"	
Cleveland, O	Brooklyn St. Ry Co	10	10, 20 more to be added shortly.	Thomson-Houston	"	Not determined; well pleased with the system.
Cleveland, O	Collamer Line, East Cleveland, O	3	8	Sprague	"	
Cleveland, O	*Broadway & Newburgh St. Ry.*	10	16	"	"	
Columbus, O	Columbus Elec. Ry	1.5	4	Short	"	Expenses ⅓ receipts; only run during State fairs.
Crescent Beach, Mass	Lynn & Boston St. Ry. Co	1	1	Thomson-Houston	"	
Dallas, Tex	*Dallas Rapid Transit R. R*	3	2	Sprague	"	
Dallas, Tex	*West Dallas St. R. R*	3	2	"	"	
Davenport, Ia	Davenport Cent. St. Ry. Co	3.5	9	"	"	
Danville, Va	Danville St. Car Co	2	4	Thomson-Houston	"	
Dayton, O	White Line St. R. R. Co	9	12	Van Depoele	Overh'd and un'gr'd con.	
Decatur, Ill	Decatur Electric St. Ry. Co	2	5	Rae	Overhead	
Decatur, Ill	Citizens' Electric Street Railway	5	4	Thomson-Houston	"	
Denver, Col	*University Park Ry. & Electric Co*	4	3	"	"	
Denver, Col	*So. Denver Cable Co*	2	2	Sprague	"	
Des Moines, Ia	Des Moines Elec. Ry. Co	7	8	Thomson-Houston	"	Has carried 90,000 passengers in one week.
Detroit, Mich	Detroit Elec. Ry. Co	2	4	Van Depoele	"	
Detroit, Mich	Highland Park Ry. Co	3.5	4	Nat. Elec. Trac. Co.	"	Average speed 18 miles per hour.
Detroit, Mich	*E. Detroit & Grosse Pointe Ry*	8	10	"	"	
Detroit, Mich	*Detroit City Ry., Mack Street line*	2	....	"	"	
Detroit, Mich	*Detroit, Rouge River & Dearborn R. R*	1	1	Sprague	"	
Dubuque, Ia	*Key City Electric Ry*	2	4	"		
Easton, Pa	Lafayette Traction Co	1	2	Daft	"	
Eau Claire, Wis	Eau Claire St. Ry	5	6 motors and 12 trail cars.	Sprague	"	Not determined; use water power.
Elkhart, Ind	*Citizens' Street Ry*	7	5	Nat. Elec. Trac. Co.	"	
Erie, Pa	Erie City Pass. R. R. Co	12	20	Sprague	"	Not determined.
Fort Gratiot, Mich	Gratiot Electric Railway	2	2	Van Depoele	Overhead	
Fort Worth, Tex	*Fort Worth City Ry. Co*	10	10	Nat. Elec. Trac. Co.	"	
Fort Worth, Tex	*Fort Worth L'd & St. Ry Co*	15	15	" "	"	
Harrisburg, Pa	East Harrisburg Pass. Ry. Co	4.5	12	Sprague	"	
Hartford, Conn	Hartford & Weathersfield Horse Railroad Co	3	3	"	"	Not determined.
Huntington, W. Va	Huntington Elec. Ry. Co	3.5	2	Short	"	
Ithaca, N. Y	Ithaca St. Ry. Co	1	3	Daft	"	Power per day, $7; expect to reduce to $5 soon.
Jamaica, N. Y	Jamaica & Brooklyn R. R.	9	10	Van Depoele	"	
Joliet, Ill	*Joliet St. Ry*	3	4	Thomson-Houston	"	
Kansas City	*No. East St. Ry. Co*	7	10	"	"	
Kansas City, Mo	Kansas City Electric Ry. Co	2	4	Henry	"	
Kansas City, Mo	*Vine St. Ry*	3	6	Thomson-Houston	"	
Kansas City, Mo	*Metropolitan St. Ry. Co*	4.5	4	"	"	
Lafayette, Ind	Lafayette Street Ry. Co	5	8 motors. 3 trail cars	Sprague	"	Per day per car, 50c.
Laredo, Tex	Laredo City Railroad Co	4	4	"	"	
Lima, O	The Lima Street Ry., Motor and Power Co	6	7	Van Depoele	"	
Long Island City, N. Y	*Long Island City & Newton Electric R. R*	3	2	Sprague	"	
Los Angeles, Cal	Los Angeles Electric Ry. Co	7	6	Daft	"	
Louisville, Ky	Central Pass. R. R. Co	10	10	Thomson-Houston	"	Not determined.
Lynn, Mass	Belt Line Ry. Co	Now 8 by extens'n of franchise.	10 when in operation.	"	"	About to start.
Lynn, Mass	Lynn & Boston R. R. Co. (Highland Line)	2	3	"	"	
Lynn, Mass	Lynn & Boston R. R. Co. (Nahant Line)	8	1	"	"	
Manchester, Va	*Richmond & Man. Ry. Co*	3.5	10	Sprague	"	
Minneapolis, Minn	*Minneapolis Street Ry. Co*	6.5	6	"	"	
Minneapolis, Minn	*Minneapolis St. Ry. Co*	8	10	Thomson-Houston	"	
Moline, Ill	*Moline St. R. R.*	3	2	Sprague	"	
Montgomery, Ala	Capital City Ry. Co	....	....	Van Depoele	"	
Muskegon, Mich.		4.5	5	Short	"	
Mansfield, O	Mansfield Elec. St. Ry. Co	4.5	10	Daft	"	Run railway and electric light plant by same power. They work well together.
Marlboro, Mass	Marlboro Street Ry. Co	3	6 motors, 5 trail cars	Sprague	"	$1 per car per day for fuel.
Meriden, Conn	New Horse Railroad	5	12	Daft	"	
Meriden, Conn	Meriden Horse R. R. Co	5	12	"	"	
Nashville, Tenn	McGavock & Mt. Vernon St Ry	3	6	Thomson-Houston	"	
Nashville, Tenn	*Nashville St. R. R*	5	8	Sprague	"	
Newburyport, Mass	*Newburyport & Amesbury Horse Ry. Co*	6	2	Thomson-Houston	"	
Newark, N. J	Essex Co. Pass. Ry	2.5	4	Daft	"	
Newport, R. I	Newport St. Ry. Co	3.75	7 motors. 6 trail cars.	Thomson-Houston	"	Not determined. A success.
Newton, Mass	*Newton St. Ry. Co.*	8	10	"	"	
New York, N. Y	New York & Harlem (Fourth Ave.) R. R. Co	18.5	10	Julien	Storage battery	5 to 6 cents per car mile.
New Orleans, La		....	1	Daft	Gibson storage battery	
North Adams, Mass	*Hoosac Valley Street Ry*	5	6	Thomson-Houston	Overhead	
Omaha, Neb	Omaha & Council Bluffs Railway and Bridge Co	14	14	"	"	
Omaha, Neb	Omaha Motor Ry. Co	35	56	"	"	Not determined.
Omaha, Neb	Omaha Street Railway Co	10	20	Sprague	"	
Omaha, Neb	Omaha & Council Bluffs R. R.	4	2	"	"	
Ontario, Cal	*Ontario & San Antonio Heights Ry. Co*	8	4	Daft	"	
Ottawa Ill	Ottawa Electric St. Ry. Co	7	8 motors. 4 trail cars.	Thomson-Houston	"	Power per day, $9; 1.1 cents per mile per twelve hours.
Ottumwa, Ia	Ottumwa Ry., Elec. and Steam Co	3.5	4	"	"	
Passaic, N. J	*Passaic St. Ry*	3	3	"	"	
Peoria, Ill	Central Ry. Co	10	15	"	"	
Piqua, O	*Piqua Electric R. R.*	3.5	4	Sprague	"	
Pittsburgh, Pa	Pittsburgh, Knoxville & St. Clair St. Ry.	2	5	Daft	"	
Pittsburgh, Pa	Pittsburgh Suburban Rapid Transit Co	....	3	"	"	
Pittsburgh, Pa	*Federal Street & Pleasant Valley R. R*	8.5	25	Sprague	"	
Pittsburgh, Pa	*Squirrel Hill R. R*	3.5	5	"	"	
Pittsburgh, Pa	*Second Ave. Pass. Ry. Co*	10	10	Thomson Houston	"	
Plattsmouth, Neb	*Plattsmouth Electric R. R.*	2	2	Sprague	"	
Plymouth, Mass	Plymouth & Kingston Ry. Co	4.5	3	"	"	
Port Chester, N. Y	*P. C. & Rye B'ch St. Ry. Co*	3	5	Daft	"	
Portland, Ore	*Metropolitan R. R*	3	4	Sprague	"	
Portland, Ore	*Willamette Bridge Co*	1.5	5	"	"	
Port Huron, Mich	Port Huron Elec. Ry. Co	4	6	Van Depoele	"	
Quincy, Mass	*Quincy St. Ry*	5	4	Thomson-Houston	"	
Reading, Pa	East Reading R. R. Co	1.5	4	Sprague	"	9⅝c. per car mile.
Red Bank, N. J	*Red Bank & Seabright Ry*	5	3	Thomson-Houston	"	
Revere, Mass	Lynn & Boston R. R. Co. (Crescent Beach)	1 (two 15 h. p. motors.)	1	[illegible]	"	Think well of the system.
Revere, Mass	Revere St. Ry. Co	4	12	"	"	
Richmond, Ind	Richmond St. Ry. Co	4	6	"	"	
Richmond, Va	*Richmond City Ry. Co*	7.5	50	Sprague	"	
Richmond, Va	Richmond Union Pass. Ry. Co	13	46	"	"	
Rochester, N. Y	Rochester Elec. Ry. C., to Ontario Beach	4.7 single, 9 double track.	9 motors, 7 trail cars.	Thomson-Houston	"	2¼c. average cost per car mile.
Salt Lake, Utah	Salt Lake City R. R. Co	6.5	10	Sprague	"	
Salem, Mass	Naumkeag St. Ry. Co	2	6	"	"	
Salem, Mass	Naumkeag St. Ry. Co	3	6	Thomson-Houston	"	ot determined.

"THE ELECTRICAL WORLD" TABLE OF AMERICAN ELECTRIC STREET RAILWAYS OCTOBER, 1889.—Continued.

LOCATION.	Road.	Length of track in miles.	No. of cars.	System.	Method.	Cost of operation and remarks,
Salem	*Naumkeag St. Ry. Co*	40	40	Thomson-Houston	Overhead	
Sandusky, Ohio	*Sandusky Electric Ry*	6.75	6	Sprague	"	
Saratoga Springs, N. Y	*Saratoga Electric Ry. Co*	2	4	Thomson-Houston	"	
San Jose, Cal	San Jose & Santa Clara R. R. Co	10	6	Fisher	"	Not operating; to change system.
Sault Ste. Marie, Mich	*Sault Ste. Marie St. Ry. Co*	2		"	"	
Scranton, Pa	*Hillside Coal Co*	1	1	Thomson-Houston	"	
Scranton, Pa	Scranton Suburban Ry. Co	5	10	"	"	
Scranton, Pa	Nayaug Cross-Town Ry	1.5	3	"	"	
Scranton, Pa	Scranton Pass. Ry	2	4	"	"	
Seattle, Wash	Seattle Elec. Ry. & Power Co	5	5		"	
South St. Paul, Minn	*So. St. P. Rapid Transit Co*	8	10	Daft	"	
Spokane Falls, Wash	*Ross Park St. Ry. Co*	7.5	6	Thomson-Houston	"	
Springfield, Mo				Fisher	"	
Sterling, Ill	*Union Electric R. R*	6	7	Sprague	"	$24 per day for 12 cars, $2 per day per car.
St. Catherines, Ont	St. Catherines, Merritton & Thorold St. Ry. Co	7	10	Van Depoele	"	Power per day, $18.32.
St. Joseph, Mo	St. Joseph Union Pass. Ry. Co	8	12	Sprague	"	
St. Joseph, Mo	Wyatt Park Ry. Co	13	18	"	"	
St. Louis, Mo	*St. Louis Bridge Co*	2	4	Thomson-Houston	"	
St, Louis, Mo		3	3	Short	"	
Sunbury, Pa	*Sunbury & N'th'land Ry. Co*	3.5	13	Daft	"	
Southington, Conn	Southington & Plantsville Ry. Co	2	2	Thomson-Houston	"	
Syracuse, N. Y	Third Ward Ry. Co	4	8	"	"	
Steubenville, O	Steubenville Elec. Ry. Co	2.5	6	Sprague	"	
Stillwater, Minn	Stillwater Elec. St. Ry. Co	5	6	"	"	
Tacoma, Wash	*Pacific Ave. St. R. R*	6	6	"	"	
Tacoma, Wash	*Tacoma Ave. St. Ry. Co*	2	4	"	"	
Toledo, O	Toledo Electric Ry. Co	2.8	{2 motor. 2 trail.	Thomson-Houston	"	Running very satisfactory.
Topeka, Kan	Topeka Rapid Transit Co	20	{30 motor. 20 trail cars.	"	"	2.06c. per car mile.
Troy, N. Y	Troy & Lansingburg R. R. Co	6	8	Sprague	"	
Vancouver Island	*Victoria Electric St. Ry. Co*	4	4	Thomson-Houston	"	
Washington, D. C	Eckington & Soldiers' Home Elec. Ry. Co	2.8	14	"	"	
Washington, D. C	*Georgetown, Tenallytown St. Ry. Co*	6	3	"	"	
West Bay City, Mich	*West Bay City Electric Ry. Co*	5	8	Sprague	"	
Wheeling, W. Va	Wheeling Ry. Co. and Citizens' Ry. Co., operated jointly	10	21	Thomson-Houston and Van Depoele	Double wire	Not determined; giving great satisfaction: travel has increased largely.
Wichita, Kan	Riverside & Suburban Ry. Co	9 increasing to 14.	8 and 2 under construction.	Thomson-Houston 6 miles; Sprague, 8 miles	Overhead	Average cost per year, $50 per h. p.; very successful.
Wichita, Kan	Wichita & Suburban Ry. Co	7.5	7	Sprague	"	
Wilkesbarre, Pa	Wilkesbarre & Suburban St. Ry. Co	6	5	"	"	Not determined.
Wilkesbarre, Pa	Wilkesbarre & West Side R. R	4	3	"	"	Expect to be in operation in four weeks.
Wilmington, Del	Wilmington City Ry. Co	3	4	"	"	
Wilmington, Del	Eighth St. Line	1.5	4	"	"	
Windsor, Ont	Windsor Elec. St. Ry Co	1.5	4	Van Depoele	"	$5.50 per day for one motor car.
Worcester, Mass	*Worcester & Shrewsbury*	2.7		Daft	"	

"The Electrical World" Table of Electric Railways.

We publish herewith a list of the electric street railways in the United States, together with a variety of important and interesting information in regard to their method of operation. The data furnished has been gathered by means of a special circular of inquiry addressed to each of the local companies in question, and the points given have been verified and supplemented by our own news columns, and special communications from our correspondents, as well as by other sources of information available. We have embodied in the table much of the information supplied, but below we give various items too bulky to be thus included. In the table, the names of the roads in actual existence are printed in ordinary type, and all extensions and roads building or under contract are shown in italics. It may be added that the table gives a total of 1,260.3 miles of track, and 1,884 cars, operating on 179 roads.

BOSTON & REVERE ROAD.—Mr. W. G. Benedict, president, says: "We have carried 10,780 passengers in a day with 5 motors and 5 conductors, with an extra man besides motor man to brake the tow car, for the reason that our road has a hill 1,000 feet long on each side. The ascent is at a grade of 7 per cent. We have carried over this grade trains of 3 open cars, with 180 passengers on, with one motor, that is, two tow cars besides the motor car. We have also made the record of two motors with one tow car each, and two conductors carrying and collecting the fares of 4,908 passengers for the day. Our repair account for five motors for 2½ months has only been $120, and they have made a mileage of about 17,000 miles, carrying about 165,000 passengers."

CHATTANOOGA, TENN.—The Chattanooga Electric Street Railway Company are renting power at present from the local electric light company, but are now putting in their own plant, to be ready December 1. They have about 10 miles under construction. They begin equipment with two 135 h. p. Beck engines and 4 Edison dynamos of 50 h. p. capacity. They expect to increase to four times the capacity. The increase in travel, Secretary S. W. Divine reports, is 50 per cent. over horse cars.

COLUMBUS, O.—The Columbus Electric Railway is, Mr. J. C. Lincoln, superintendent, reports, using an underrunning trolley with a sliding contact, with the Short system, and it "gives perfect satisfaction."

EAU CLAIRE, WIS.—The city lighting Brush plant and a dynamo for stationary motor current are run from the same shaft (run by water power) as the dynamo furnishing current to the Eau Claire Street Railway, W. G. Root, superintendent.

ASHEVILLE, N. C.—The Asheville Street Railway Company use bituminous coal, short ton, costing $3.65 to $3.85 at power station. The cost of power is $2.50 per car per day for five cars of the 16-foot type. The charge for power is a "flat rate," as the station is also running arc and incandescent lights. Details of the road have appeared in these columns from time to time. Mr. John H. Barnard, superintendent, has been so satisfied with the results that he writes that he is becoming agent for the Sprague Company. "This road," he says, "is a treasure in its operation and earnings."

OTTAWA, Ill.—Mr. T. J. Evans, of the Ottawa Electric Street Railway Company, writes us: "The Ottawa Electric Street Railway has seven miles of single track with turnouts, eight motor and four trail cars of the Thomson-Houston system; method, overhead. Cost of power per day, $9; per mile, $1\frac{1}{10}$ cents for twelve hours. We shall add four more motor cars and three miles of road. With the additions, cost will be 80 cents per car and $\frac{8}{10}$ of a cent per mile for power. You ask me for a few suggestions as to the special methods and details to be adopted in practical work in the department of electrical railroading. In entering upon the construction of an electrical railway, I would employ a first-class electrical and mechanical engineer I would use nothing less than a 40-pound 'T' rail or a 45-pound girder-rail in making the roadbed. I would build larger engines, boilers and generators than were required to do the work. I would double up the size of the motors to be used on the cars, than what would ordinarily propel them, for durability and economy. I would use plenty of copper wire overhead and along the rails with large rivets with frequent grounding to insure a perfect circuit to more nearly overcome the resistance, the noise and jerking in starting and stopping the cars. I would avoid sharp curves in road construction of less than 60-foot radius. I would avoid all sharp angles in overhead work. I would let the trolley or main wire always be over the centre of the track, the suspenders or ear plates perpendicular, the height from the rail be uniform so as to avoid unnecessary friction on the trolley journals. I would use feed wires on all circuitous lines, so as to bring them as near as possible to the direct line of the generator to maintain a uniform voltage over the entire line. I would require the electrical companies to use the best Okonite insulated cables and connecting wires on the car and house wiring, carefully attached and protected, as cheap and defective wiring of cars and houses has been the cause of more annoyance and expense than all other sources combined, causing grounds and short circuits; consequence, burnt field coils, rheostats, armatures, commutators, lamps, etc., and occasionally broken engines. I would require them to give guarantees against imperfect wiring on the completion and turning over of your road. Short circuits are the result of poor material and bad mechanism. With all these points guarded, as a practical engineer will be in his specifications and acceptance, you will have a road that can be operated from the time you turn on steam. You will not have to buy duplicate motor cars, or build extra storehouses, or keep well equipped machine shops to keep alternate cars on the road."

SEATTLE, WASH. T.—Mr. S. H. Griffith, manager of the Seattle Electric Railway and Power Company, says: "We are now completing a new power station with two Reynolds-Corliss engines of 200 h. p. each. We have an Armington-Sims engine running an 80-h. p. Thomson-Houston generator, and will have five. The station will be a brick building two stories high, 60 × 256 feet. We are extending our system. The present line has not a single block without grade."

Mr. C. F. Heinrichs' Compliments.

To the Editors of The Electrical World:

My attention has been drawn to a minor editorial in your last issue. The insinuations and vituperations contained therein have *not* surprised me, since I perfectly well know the present unscientific and mainly commercial tendency of a certain part of the scientific press.

You admit that you do not exactly know my motives (which induced me to expose the imperfect insulation of the high voltage current wires, causing death and destruction almost every week). I, however, exactly know your motives which led you to attack me in this unwarranted and personal manner.

Had you kept to the facts, and stated how far I had been in error in regard to the altogether imperfect insulation of the high voltage wires, I should have given such statements due and respectful consideration, and if in error, I should have been most anxious to admit it, but I shall certainly not take any further notice of similar attacks as you have indulged in, simply to please the high voltage combination at the cost of truth and public interests.

The mayor, the respectable press and the public will not be misled by your unfounded and personal attack. Every impartial-minded person will conclude from your intemperate language that I have hit the bull's eye in this matter, and that the soreness of the spot I touched upon made you and your high-voltage friends forget that we are here in the most civilized State, and that the respectable press eschews and condemns purely personal attacks.

I never attacked an arc light system (or any other system). Your statement to that effect is simply an untruth, and you published it as such.

I request you to publish the above in your next issue.

CHARLES F. HEINRICHS.

NEW YORK CITY, Oct. 7, 1889.

We are extremely sorry that our criticism of Mr. Heinrichs' methods should have hurt his feelings. We offer him our apologies, and, in withdrawing the offensive language, beg to substitute the following from the *Evening Sun* of October 9:

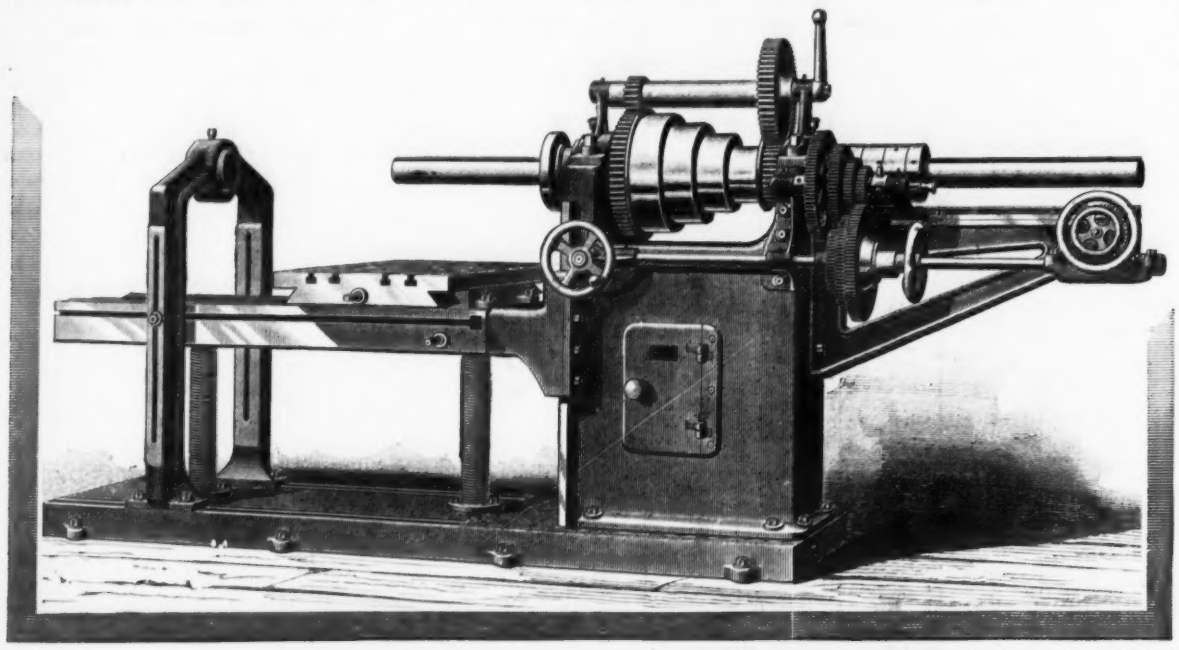
"Referring to Mr. Charles F. Heinrichs, the electrical engineer, who yesterday wrote a letter to Mayor Grant, Mr. Hoag thought that Heinrichs spoke unadvisedly when he made assertions of facts about which he knew nothing.

"Coroner Schultze, who will conduct the inquest in Erdman's case, said that he knew Heinrichs, and he regarded him as a meddler.

"He was just in here," the coroner said, "a few moments ago, and I fired him out. The fellow told me that he was going to attend the autopsy this afternoon, and that if I did not admit him he would make trouble for me. He thrusts himself forward here because he has patented an insulating process which he hopes to advertise. You notice that in his letter to the Mayor he says that there is no such thing as absolute insulation. Then he immediately adds that some insulating methods are better than others, but as they cost more they are less frequently used. Well, his insulating method is the kind that costs more, and consequently is not used. Do you see?" When the coroner had finished he looked like a man who had relieved his mind of a great burden."—EDS. E. W.

New Horizontal Drilling and Boring Machine.

The accompanying illustration represents a new horizontal drilling and boring machine, recently brought out by the Newark Machine Tool Works, of East Newark, N. J., which is well adapted to the boring and drilling of dynamo parts. For this purpose the work is bolted to the compound carriages which are shown directly under the boring bar, the work being set square by the top surface and the edges of the carriage, which are absolutely true with regard to the bar.



NEW HORIZONTAL DRILLING AND BORING MACHINE.

The carriages can be moved either across or along the movable table, which is shown supported by the two large screws. The table can be lowered or raised from the side or at the end as desired. With these movements of the table and carriages, using no blocks whatever, the work can be set quickly and with the utmost accuracy, as all the surfaces and motions are absolutely true with regard to the bar. A yoke of great strength braces the table and serves as a bearing for the bar, or boring arbor.

The boring bar is fed by a rack and pinion, and it is held by a friction clamp, so that, by easing the clamp and taking another grip, a very long feed can be obtained. The extreme feed is about 5 feet and the feed without change is about 34 inches. The feed gearing is very strong, and there are three automatic feeds in either direction, instantly changeable from one to the other. The bar can be fed by hand, also, giving it a quick advance or return.

The Rowell Switch for Electric Railways.

The switches and turn-outs, which are the invariable accompaniment of all railways, as a rule require the attendance of a special switchman where the traffic is very heavy; or where the traffic is not so heavy, the conductor is usually obliged to stop his car, dismount and throw the switch by hand. This, of course, involves a delay, while in the case of heavy traffic it involves the additional expense of a switchman. In order to avoid this, the Rowell American Switch Company, of Boston, Mass., have recently brought out an ingenious track device which, in connection with the simple mechanism on the car, permits the switch to be thrown without stopping the car, and by the simple motion of a lever on the platform.

The accompanying illustration, Fig. 1, shows a plan view of the track, showing the top of the switch-box and tongue, while Fig. 2 shows the same in section, together with the car as it passes over the switch. As will be seen, the switch is operated by two upright arms at the side of the track, near the rail, and directly under the axle-box of the car. These upright arms or levers are connected to two arms upon a rock shaft, which controls the switch tongue by a connecting rod and crank, as shown. These upright arms opposite the track are operated by either of two wheels hung from the axle-box. When in use they are brought up close to the truss of the car by a spring, and are brought into position to set the switch by a lever placed on the platform in front of the driver. This lever is operated by hand, but can also be arranged to be operated by a pressure of the foot, thus leaving the driver entirely free to control the car as usual. The device, it will be seen, is a very simple one, and does away with all the annoyance caused by the setting of switches usually experienced.

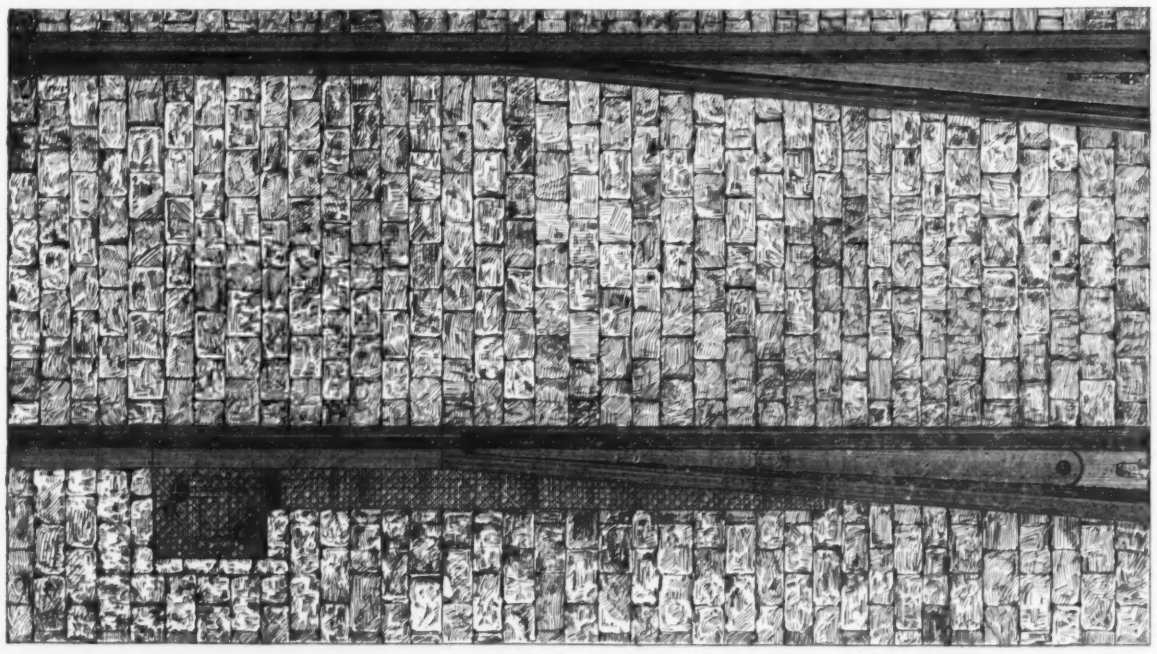


FIG. 1.—THE ROWELL SWITCH FOR ELECTRIC RAILWAY TRACKS.

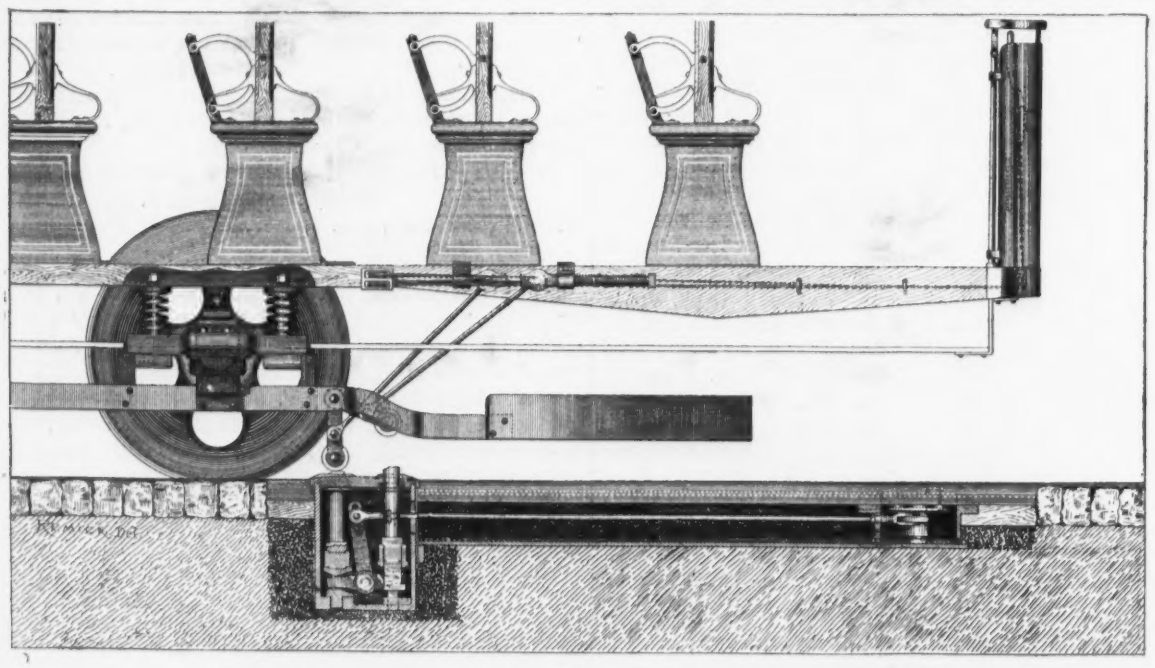


FIG 2.—THE ROWELL SWITCH FOR ELECTRIC RAILWAY TRACKS.

A New Railway Signal Device.

Some trials were recently made on the Nottingham Suburban Railway of an apparatus devised by Mr. W. Andrews, of Nottingham, the primary object of which is to afford means whereby the driver of a locomotive may tell exactly how the signals are at particular points on the railway over which his train is proceeding. For the experiments a mile and a quarter of the suburban line, running from Sherwood Station toward Daybrook, was selected. Parallel with the permanent way there was a zinc-covered wooden rail. By means of a brush attached to the foot-plate of the engine the circuit of two dials placed on the weatherboard of the locomotive was established in turns. One of the dials was in the form of a miniature semaphore signal, the other being similar in appearance to a steam gauge dial, and capable of registering distances from a quarter of a mile up to nine miles. An operator was stationed at each end of the line, and when, acting upon a previously arranged code, the signals were put on or taken off, the fact was at once indicated on the engine. By means of the second dial the distance between various points was also indicated. Mr. Andrews is sanguine that his signaling apparatus would prove of the greatest value in foggy weather when the ordinary signals cannot be seen, as at any point from 200 to 400 yards outside the distance signal the driver would be able to tell at once in what position the particular signal might be, and whether he was at liberty to proceed.

The Difference Between Primary and Storage Cells.

To the Editors of The Electrical World:

In a recent issue, the answer that G. Trebel, M.D., gave to this question, does not seem to be just correct.

A storage cell before it is charged may or may not be a primary battery. It is usually a very poor primary battery. If the coating on one plate is of a higher oxide than that on the other plate, or if one plate has a coating of oxide and the other is of a different composition, then you would have a primary battery. In the pasted plates of to-day (which will not be the plates of to-morrow) the paste on one plate is of a higher oxide than that of its neighbor, and therefore the plates are dissimilar, and not similar, as our friend from Hamilton states. I also object to the statement that "both plates are electrolyzed, one receiving a coating of spongy lead and the other sulphate of lead." I agree that one plate becomes spongy lead, that is, lead reduced by hydrogen, which reduced lead is capable of holding within it a greater or lesser amount of latent hydrogen, which hydrogen becomes active as soon as the battery is allowed to discharge. I cannot agree with the statement that the other plate receives a coating of sulphate of lead. I believe that the sulphating of the active material, or material to become active, within a certain limit is desirable, in forming a coating of oxide, which is the ultimate result.

The two dissimilar metals are oxide of lead (oxygen), reduced lead (hydrogen), and it is to these two gases that the secondary current is due, and not to spongy lead and sulphate of lead.

First. The electrolysis of a solution which contains oxygen and hydrogen, more or less oxygen being stored up at one pole in the form of a high oxide of lead and latent oxygen, and more or less hydrogen being stored up in the spongy lead, that is, reduced by the hydrogen.

Second. The discharging of the cell, which is the oxygen going to what was the oxygen pole, the oxide giving up oxygen, the spongy lead giving up hydrogen.

Third. There is to a considerable extent, a re-electrolysis of the solution.

A storage cell, when not subjected to a current, *may be a battery.*

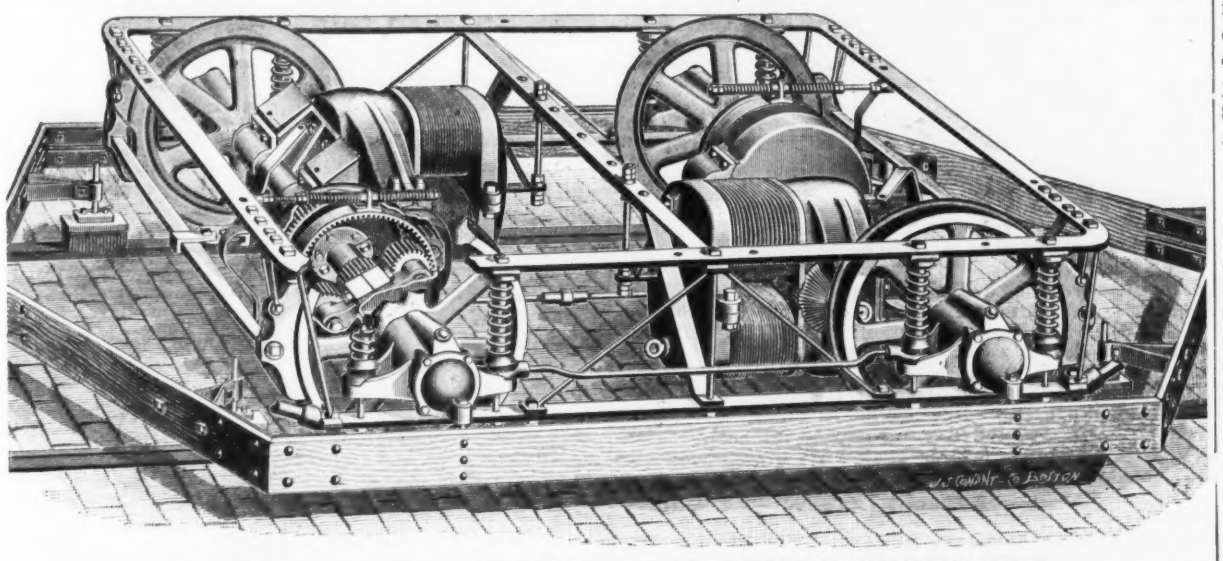
N. B. Aldrich, M. D.

Fall River, Mass.

The New Storage Car of the Union Electric Car Company.

The new railroad just built between Beverly and Danvers, Mass., was opened for traffic recently, the system employed being that of the Union Electric Car Company, of Boston.

The road is three miles in length, and is an almost continuous line of quite heavy grades and curves, there being not more than 500 feet of level track in the whole route, and some of the grades are from six to eight per cent., so that it is a piece of road to thoroughly test the efficiency of the storage battery, which is the source of



THE TRUCK OF THE UNION ELECTRIC CAR COMPANY, BEVERLY ROAD.

power used, to surmount heavy grades and make time, and show that this method of propulsion is to be relied upon, both as to time and economy of running.

The track is built of T-rail, 40 pounds to the yard, laid on and spiked to ties two feet on centres, well tamped and ballasted. The car-house is situated at Beverly, near the end of the track, and is 90 feet long by 40 feet wide.

There are two tracks running through the car house, laid on stringers resting on posts, and leaving a subway or pit which permits convenient access beneath the car. On each side of the tracks are charging tables, on which rest the batteries when being charged, with electrical connection between the dynamos and the tables. The tables are the same height as the floor of the car, so that the trays containing the batteries are easily drawn from the cars to their places on the tables, and pushed into the cars from them. These table circuits are controlled at the switch-board. There is an annex 30 × 28 feet, in which is located the power used for charging the batteries, consisting of a 35 h. p. upright boiler, a 35 h. p. Westinghouse compound engine and a 30 h. p. Weston dynamo, with switch-board, ammeters, etc. This plant is sufficient to charge the batteries for six cars, each car having two sets, one being charged while the other is in use. With each set the car is run 40 miles, thus making the daily service 80 miles per car.

The equipment at present consists of two box cars of great beauty and finish. The trucks of the cars were built by the Trip Roller Bearing Company and have their roller-bearing boxes. As will be seen in the figure, there is a motor on each axle, the armature being geared through the special gearing, patented by the Union Electric Car Company, to each axle. The dust-proof closed gear case is shown closed on one axle and the case broken away on the other to show the inside gears. These cases are partly filled with oil, so that the gears run in a bath of oil and are almost free from friction. A description of these gears as used on the transfer-table in use by the Fitchburg Railroad at their car shops has already appeared in our columns, the same system being used in both. The 138 batteries are each placed in the Huestis patent battery boxes furnished by the Newton Rubber Company, and are made of an entirely new material, taking the place of the hard rubber ones formerly used. They are placed in twelve trays, six on each side, and are placed under the seats of the cars. They are put in through the long doors let down on the outside of each car. The cars are lighted by four 16 c. p. lamps in the roof; electrical bells for passengers and conductors are placed over the seats and at each end.

One of the important features of the Union Car Company's system is the "charging-back" device with a series wound motor, thus utilizing the power otherwise lost in slowing, stopping or holding the car in going on down grades, while at the same time securing perfect and complete control of the car through the switch, which is placed on the dash-board on each end of the car. The driver does not need to use the mechanical (hand) brake, but can brake the car with the movements of the switch handle. The charging back into the batteries, or line if it is an overhead one, in going down a grade effects considerable gain, and is shown by the ammeter used on the car to be very nearly as great in some cases as that taken in going up the grade.

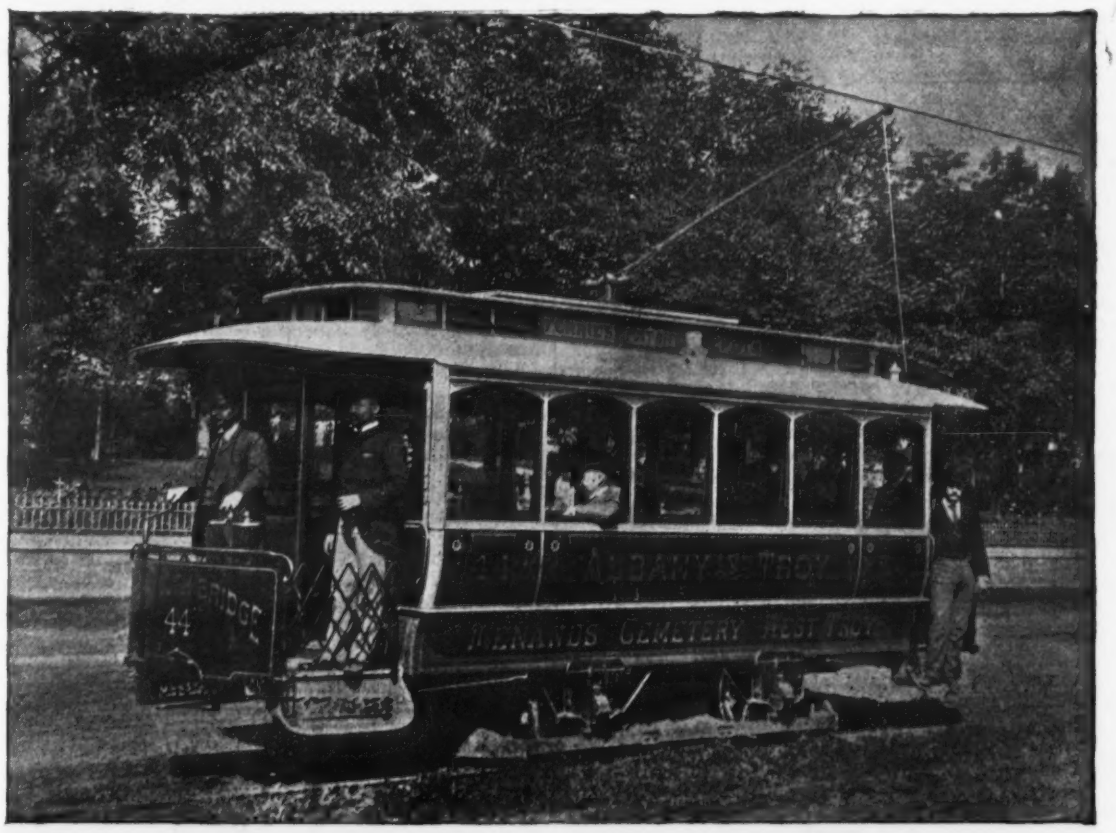
The cost of equipment of this railroad with battery cars is claimed to be less than if overhead wire conductors had been used, while the running expenses will, it is estimated, not exceed one-half what they would be with the overhead system. We are informed that the management intends to publish weekly statements of all expenses, and those interested will be given every opportunity to examine the equipment.

The Thomson-Houston Electric Railway at Albany, N. Y.

The accompanying illustration is made from a photograph of the Watervliet & Turnpike R. R., Albany, N. Y. which has been in operation since Sept. 29. and which was equipped by the Thomson-Houston Electric Company, of Boston, Mass., with their railway system. The road consists of seven miles of double and 8¾ miles of single track, making a total of 22¾ miles. The maximum gradient of the road is 4.2 per cent. The car equipment consists of 16 cars, each equipped with two 10 h. p. Thomson-Houston railway motors, and 38 tow cars, 31 of which are box cars and seven open. The cars were built by the Jones Manufacturing Company, and are well made and finished.

The power station, a one-story brick building, is situated about halfway between the terminals of the road, and adjacent to the car-house, which has a capacity of 35 cars. The steam plant consists of three steel boilers of 150 h. p. each, and three 125 h. p. engines built by the Taylor Manufacturing Company.

The electrical apparatus comprises three 80 h. p. Thomson-Houston railway generators belted direct to the engines, and all the electrical appliances necessary for satisfactory operation.



THE THOMSON-HOUSTON ELECTRIC ROAD ALBANY, N. Y.

The operation of the cars since the day of starting has been eminently successful in every particular, and has thoroughly convinced some of the prejudiced ones, who were inclined to oppose the introduction of the electric railway, that it has reached the point where its commercial and practical success cannot be questioned. The cars begin running at 6:15 A. M., on 15 minutes' headway, and continue until 10:45 P. M. The day on which the cars were started was one of considerable excitement in Albany, and the cars were patronized by thousands of people, who expressed a general opinion in favor of the electric railway.

Annual Report of the Western Union.

The annual meeting of the Western Union Telegraph Company was held last week, the old board of directors being re-elected. The company's gross revenues for the year ending June 30, 1889, were $20,783,194, an increase of over $1,060,000. Operating expenses decreased about $100,000 to $14,565,152, making net earnings of $6,218,041. The year's surplus is $1,072,866, against $496,364 for 1888. Over 7,000 miles of new poles and 30,000 miles of new wire have been added during the year. The messages of the year aggregated 54,108,326, against 51,463,955 in 1888, 47,394,530 in 1887 and 43,289,807 in 1886. The official figures show that in ten years the company has increased its mileage 115 per cent., its messages 116 per cent., its offices 116 per cent. and its wires 206 per cent. The stock capital of the company has not been changed during the year; but the bonded debt has grown from $6,737,088 to $12,056,012, the increase being due to the issue of $5,361,000 5 per cent. bonds against guaranteed securities.

Power Transmission at Bourganeuf, France.

In a recent number of the *Comptes Rendus*, M. Marcel Deprez gives some particulars with regard to the transmission of power installation at Bourganeuf, where, owing to the frequent failure of the waterfall in the town itself, it has been found necessary to obtain the power for driving electric light machines from a fall at Les Jarrauds, nine miles off. The generator has two armatures connected in series, and mounted on the same spindle. Each ring has a resistance of two ohms, and revolves between the poles of a separate field magnet. The generator is belt-driven by a 130 h. p. turbine running at 150 revolutions. The field magnets are partly excited by a small auxiliary machine giving 90 volts and 20 ampères. The line, which has a resistance of 23 ohms, is of bare 5 milimetre silicium bronze wire. The motor at Bourganeuf is identical with the generator at Les Jarrauds, and, like it, is independently excited, in this case by the electric lighting machines. At the moment of starting, however, the field is excited by the accumulators at the central station. The dynamos, two in number, are of the Gramme type, giving 110 volts and 250 ampères. In preliminary workshop experiments over an artificial line of 30 and 25 ohms resistance, it was shown that for every 100 h. p. developed by the turbine, at least 60 h. p. was available for lighting purposes, the E. M. F. of the generator being between 3,550 and 3,750 volts.

Trouble with a Short Telephone Line.

To the Editors of The Electrical World:

Would you kindly give me information on the following matter? I have a telephone of the regular style (battery telephone) which I have experimented with successfully on a line of about four miles. Now I use it in my house from the third floor to the first floor, with gas pipes as return and the same cells at each end, but do not get as good results as before.

Does the difference of resistance between the short and long circuit interfere with the good working of the instruments? C. F. R.

BROOKLYN, L. I.

ANSWER.—The shortening of the length of the line ought to favor the transmission, if anything. If you are certain that the battery, receiver and transmitter are in good condition, the fault must be on the line somewhere. Probably a ground has developed which deflects a good part of the current. It would be well to look for the trouble in this direction.—EDS. E. W.

Meeting of the Board of Electrical Control.

In response to a letter from Mayor Grant inviting the electric lighting companies to attend the meeting of the Board of Electrical Control to consider the matter of preventing fatal accidents by contact with electric light wires, representatives of the principal companies interested were present at the Mayor's office on October 9. The meeting was a succession of lively episodes. The proceedings opened by the reading of a letter from the board of Coroners relative to the recent deaths of the Italian, Mazzi, and others which were held to have been caused by the dangerous use of overhead wires in crowded streets.

A letter from the United States Illuminating Company was then read, in which they pleaded earnestly for increased facilities for the transaction of their business. They showed that in many places where they had wires to go in there were no subways, and even where there were subways they were already overcrowded. The usefulness of the subways laid down was much impaired by the absence of distributing ducts; the rate at which the subways were being constructed was manifestly incommensurate with the requirements of the rapidly growing electric light business, and practically no progress could made. These points were all duly set forth to introduce the proposition of the company that it be allowed to build its own subways, which it was ready to do promptly and well.

Mr. LAUTERBACH, who represented the Consolidated Telegraph and Electrical Subway Company, went into a very graphic description of the early struggles of his company, and the opposition they had to fight against up to the time that the fiat, "The wires shall go underground," was launched forth by Mayor Grant. He showed that since then, in the face of unfavorable conditions, they had still pushed on their work as rapidly as possible, without asking for help of any kind. By the end of this season 20 per cent. more work would be done than had ever been done before. His company had done its work faithfully, and he appeared not in a defensive, but in a belligerent, attitude. He explained how it was that the progress of the work had been so slow, and earnestly opposed the suggestion that the electric light companies be allowed to build their own subways, and at the same time he questioned the legality of such a step.

Mr. WHEELER H. PECKHAM then rose as the representative of the Standard Electrical Subway Company. He said that with the permission of the board he would present a simple and ready solution of the difficulty which now seemed to be impeding the carrying out of the Mayor's views on the underground question. The Subway Construction Company had been working for a considerable time, and had only completed 12 or 14 miles of subway. Fully 100 miles were needed immediately to meet the requirements of the electrical business. His company, which had been formed only a few months, had all the money and the facilities for pushing work. They proposed to carry on their operations in such a way that there would soon be no excuse for overhead wires. They could give all the necessary bonds, and the instant the contract was signed they were prepared to put on to the work 3,000 or 4,000 men.

Commissioner GIBBENS said he was doubtful whether the board had the power to make any contract with the new company.

The MAYOR said he would consult the Corporation Counsel before taking any steps.

Upon the Mayor's asking whether any of the electric lighting men present were prepared to express any opinion on the subject for the consideration of which the meeting was called, Mr. Foster, representing the Mount Morris Company, said that his company had been fortunate in its exemption from accidents, but they considered that it was advisable to have the wires underground with as little delay as possible. They were ready now to go into the subways, but the accommodation was insufficient. In the meantime, he thought the difficulty could be met by strong poles and well-insulated wires.

Mr. YOUNG, the electrician of the Mount Morris Company, said that the accidents that had taken place were due to imperfect insulation and overloading the circuits. On being questioned by the Mayor, Mr. Young said that a wire carrying an alternating current can be made safe to handle by insulation. He knew of such a wire on Greenwich street, below the company's station. The Mayor asked if the connection could be properly insulated, and Mr. Young said that the workmen made the connections with live wires with perfect safety. "Well," said the Mayor, "our experience has been that they get news of all who touch the wires through the coroner's office," and, in spite of the testimony just given, he said he retained his conviction that alternating current wires could not be handled without danger.

President JACKSON, of the United States Illuminating Company, then reiterated the grievances that had been set forth in the letter already alluded to, and said the difficulty of making an overhead wire safe was exceedingly great. There were all sorts of contingencies to be provided against, and these were so numerous that you could not possibly insure immunity from them. Such things as storm breakage and contact with other wires, for instance, would make the best insulation of no avail. On being asked whether his company had any safe wires, Mr. Jackson said they had some that they believed to be good, but he would rather be excused from touching them.

Commissioner GIBBENS said that if he believed the opinion that Mr. Jackson had just expressed, he would vote to refuse all applications for overhead electric light wires or lamp connections, and offer a resolution that no more such circuits be operated overhead. The Mayor said immediately that he would certainly vote for such a resolution if it were offered; but Mr. Gibbens went on to say that he had no intention to offer it, as he was not in accord with Mr. Jackson's views. He thereupon made two or three attempts to get from Mr. Jackson an answer to the question whether the accidents were due to the impossibility of properly insulating the wires, or to the fact that they were not properly insulated and that the circuits were overloaded, but he failed to secure a satisfactory answer. Expert Wheeler said that if the rules of the board were carried out the accidents would not occur.

Mayor GRANT: Then don't you feel some responsibility for these deaths?

Dr. WHEELER: I do not.

Mayor GRANT: I do, and I think you have put yourself in a position to justify somewhat the presentment of the coroners.

Dr. WHEELER: What could I do? My orders have not been carried out.

Commissioner GIBBENS said in support of Dr. Wheeler's opinion that if the regulations were enforced these accidents would not occur.

The MAYOR: "Well, let us see then that they are enforced. The companies are all represented here. Let us call upon them to see that the wires are properly insulated. I must say I do not agree with the opinion that the wires can be made safe, and I am not ready to say that I am responsible for these deaths because they could have been avoided under rules of this board. Before I would take that position I would order every electric light wire down to-day."

After a very animated discussion, in which it seemed impossible for the members of the board to arrive at a common issue, the meeting was adjourned for an hour, after which the following resolution was adopted:

"*Resolved*, That notice be given to all companies operating and furnishing electric lights on overhead wires in the city of New York to discontinue the use of such overhead wires as are not properly insulated until such time as said wires shall be certified to by the expert of this board to be in proper condition."

The MAYOR said that after this notice was sent to the respective companies the expert would be responsible for any deaths that might occur from electric wires. Dr. Wheeler asked if he should satisfy himself as to each wire. "Yes," replied the Mayor, "and I want it understood that if the wires were not properly insulated, if they are death-dealing and dangerous, they must be taken down."

The board adjourned to 11 o'clock the following day, when there were some lively passages between the Mayor and Dr. Wheeler, and eventually Commissioner Gibbens offered the following resolution: "*Resolved*, That the several electrical companies be notified to replace all defective and improperly insulated wires with properly insulated wires, and that the expert of the board be directed to inspect all wires of all companies as rapidly as possible, and that the State Civil Service Board be directed to select four inspectors who shall report all wires found dangerous to his Honor, the Mayor." But the Mayor refused to allow this to be substituted for the resolution of the previous day, and without further action the board adjourned.

The companies do not want to fight, but they are understood to be preparing injunctions in case the threatened, uncompromising policy of Mayor Grant is carried out.

The Decision Against Kemmler.

On Oct. 9 County Judge Day filed his decision in the Kemmler case, which, it will be remembered, was a habeas corpus proceeding to test the constitutionality of the electrical execution law. The judge decides that the law is constitutional, and remands the prisoner to the custody of Warden Duston, at Auburn Prison, for execution. In discussing the question of cruel and inhuman punishment Judge Day says:

"The Constitution of the United States and that of the State of New York, in language almost identical, provide against inhuman punishment; but it may be remarked, in passing, that with the former we have no present concern, as the prohibition therein contained has no reference to punishments inflicted in State courts for crimes against the State, but is addressed solely to the National Government. Section 505 of the Code of Criminal Procedure, in force prior to the enactment of 1888, provided that the punishment of death should, in every case, be inflicted by hanging. It is this attempted change in the mode of inflicting the death penalty that provokes the present controversy. The question of the constitutionality of this law is of importance, for, apart from any other consideration, should it ultimately be held unconstitutional, not only may the condemned possibly escape his desert for adjudicated guilt, but all other persons committing capital crimes since the beginning of the current year may likewise go unpunished, inasmuch as it is expressly provided in Section 10 of said chapter that after it takes effect a crime punishable by death must be punished according to its provisions and not otherwise, and it is clear that any penal act hereafter passed to apply to those cases would necessarily and justly be held void as post facto. There is no precedent to this case. Section 2,031 of the Code of Civil Procedure provides that the court or judge before whom the prisoner is brought, by virtue of a writ of habeas corpus, must, immediately after the return of the writ, examine into the facts alleged in the return and writ, the cause of the imprisonment or restraint of the prisoner. It was because the burden of satisfying the judicial mind of the cruel and unusual, and therefore unconstitutional, character of the law in question was upon the defendant, and to afford him an opportunity to present the facts as he claimed them to be, that as the better course the reference was ordered.

"There seems to be an element of cruelty inseparable from any taking of human life as punishment for crime, but it is clearly not against this that the constitutional prohibition is directed. It was held by the Supreme Court of the United States in the Wilkinson case that a sentence to death by shooting was not illegal in Utah. The common law rule in this State when applied was adopted, and until the act of 1888 took effect, and no question was made as to the legality of death by hanging. That statute but changed the means whereby to produce death. And can it be said that in this case it has been plainly and beyond doubt established that electricity as a death-dealing agent is likely to prove less quick and sure in operation than the rope? I believe not. A legislative act is not to be declared void upon a mere conflict of interpretation between the legislative and judicial power. Before proceeding to annul by judicial sentence what has been enacted by the law-making power it should clearly appear that the act cannot be supported by any reasonable intent or allowable presumption.

"Applying, then, these principles to the present case, the questions are whether the prisoner has overcome the presumption that the statute of 1888 in regard to the infliction of the death penalty provides a cruel and unusual and therefore unconstitutional punishment, and that a force of electricity sufficient to kill any human subject with celerity and certainty, when scientifically applied, cannot be generated. In my judgment these questions must be answered negatively. The most that can be justly said in his favor is that there is diversity of opinion on the principal question. Before the statute can rightly be abrogated there should be judicial knowledge that the punishment therein provided is cruel and unusual. There is no such knowledge, and his contention fails. In any case the gravity of the matter demands it to be left to the courts to determine. If it is doubtful that electricity will kill at once and, therefore, painlessly in every instance in which it may be administered to take the life of a culprit as condign punishment, his client should be discharged. Having thus sufficiently indicated the grounds of my decision, consideration of the other questions suggested on the argument is unnecessary."

It is understood that Kemmler's counsel will carry the case to the Court of Appeals.

Obituary—Timothy Cornwell.

Death has again entered the ranks of the business and manufacturing world, and this time chosen for its victim indeed a shining mark, Timothy Cornwell, the able and trustworthy secretary of the New York Belting and Packing Company. Mr. Cornwell was a man of great energy, an indefatigable worker, and won for himself the love and esteem of a large circle of friends and acquaintances, and a reputation far and wide for a generous and loving disposition and sterling integrity. His demise is a great loss to the company, and the business community at large has lost one of its highest ornaments. He was sixty-two years of age. His long association with Mr. C. A. Cheever brought him into frequent and close contact with electrical men during the past ten years, and there are many such who, like the present writer, learned to appreciate and value his many manly qualities.

Electrical Notes from Cornell University.

The total registration of students up to date is about 1,250. Out of a total freshman class of about 450, forty-nine are registered as intending to take the electrical engineering course, being the largest number entering any one course, except that of mechanical engineering.

Eighty-eight juniors and fifty-one seniors are registered for physical laboratory practice.

The number of men entering for advanced work is larger than ever before. There will be from 15 to 18 students doing resident graduate work this year.

A five-light Waterhouse dynamo has been presented to the electrical department by the Westinghouse Electric Company through the kindness of Mr. F. G. Waterhouse and Mr. Pease.

The new chemical building, the plans of which call for one of the most finely equipped buildings of its kind, is well under way, and will probably be ready for occupancy next fall. Upon its completion the whole of Lincoln Hall (physical laboratory), the upper stories of which are now partly occupied by the chemical department, will be used as a physical laboratory. This will, of course, give increased facilities to electrical engineering students.

As foreshadowed in THE ELECTRICAL WORLD last June, Mr. Ryan has been appointed Professor of Electrical Engineering. The selection is a most popular one, and all unite in wishing Prof. Ryan the best of success. The professor has outlined an entirely new course in his department for seniors. Two hours a week are to be devoted to lectures on the designing of dynamos, stations and to electrical problems of construction in general; and this class-room work is to be supplemented by an entirely practical course of nine hours a week draughting.

Announcement is made of a new two-hour course in the "Theory of Dynamo-Electro Machines" by Mr. Merritt, last year Fellow, and now instructor in physics. The course is elective and is intended to be supplementary to Prof. Ryan's work.

Prof. Nichols' lectures this term to seniors will be on the general subject of "Electrical Measurements."

Professor Ryan, at the Toronto meeting of the American Association for the Advancement of Science, read a paper upon a new type of quadrant electrometer, which has proven especially valuable in the study of alternating currents. Professor Ryan and Instructor Merritt were busily engaged during the past summer in investigating transformers by means of this electrometer. They succeded in getting a complete set of simultaneous curves representing the actions taking place in the transformer at any one time. A paper giving a further account of the electrometer and the result of their investigations may soon be expected.

During the past summer *La Lumière Électrique* has had two very prettily written articles by M. Palaz on incandescent and arc lights and photometry. These articles were based almost entirely upon two papers read by members of the physical department at the last meeting of the American Institute of Electrical Engineers, and upon a paper by Mr. Merritt on incandescent lamps. The articles were in the nature of a general summing up of these papers, and are gratifying as showing the appreciation in which Cornell is held abroad.

Notes of the St. Louis Electrical Exposition.

ST. LOUIS, Oct. 9, 1889.

THE ST. LOUIS EXPOSITION.—At the present writing there is such a decided improvement in the appearance of the space occupied by the electrical section at the St. Louis Exposition that it is now the leading feature and the one most attractive. Several exhibits delayed en route have arrived and been placed in position, thus nearly filling all the vacant spaces, and in two cases increasing the number of lights in operation. However, Mr. Whipple has placed a hundred extra arc lights and several hundred extra incandescent lamps within the section, which practically flood the space with light, and add very much to the attractiveness of the display. The commercial results of the display to the individual exhibitor are reported as most gratifying, many sales having been effected, both of machinery and of supplies. For instance, the Thomson Electric Welding Company report the sale of a dozen machines, four going to one house in St. Louis; the Excelsior Electric Company report having sold over 40 h. p. in motors and more than 100 arc lights; the William Powell Company, of Cincinnati, report "having secured orders the first week that more than offset the entire expenses that will be incurred by reason of the display," and so on through the entire class of exhibitors, until the directors of the association have about concluded that a permanent electrical exhibit would prove a constant source of attraction and a profitable investment. The display of incandescent lights in the Music Hall during the evenings devoted to special entertainments, such as *American* night, etc., have been instrumental in bringing to the notice of many who had never given the subject much previous thought the importance of the incandescent lamp in enabling such beautiful displays to be so easily secured; effects that harmonize readily with surroundings of whatever nature; that can be made intense, or soft and mellow, as may appear most appropriate, and one in which the element of safety is a prime factor.

THE ST. CHARLES CAR COMPANY have placed a handsome street car on exhibit.

THE SPRAGUE ELECTRIC RAILWAY AND MOTOR COMPANY are now operating a single car on a track running nearly the entire length of the building. A No. 8 Edison dynamo furnishes the current, and the beautiful Stephenson car containing every modern feature is filled with ladies and children eager to experience the pleasure of an "electric ride."

A SIMPLEX ARC SEARCH LAMP has been placed at a prominent point on the building, and attracts much attention, the current being supplied from the Edison plant.

CHAS. A. SCHIEREN & CO., of New York, have a neat exhibit of leather dynamo belting and perforated electric belting that attracts attention. Samples of the superior stock from which their belts are made are also shown. Mr. F. W. Baugher is looking after the display.

THE ROSE ELECTRIC LIGHT SUPPLY COMPANY, of St. Louis, have an excellent display of second-hand dynamos and motors that prove very attractive to prospective purchasers. Among the apparatus are two 35 arc light Jenney dynamos, with full complement of lamps, a Poland dynamo, two American dynamos, etc. Mr. P. L. Rose is in charge.

THE LOCKWOOD AMMETER AND POLARITY INDICATOR is being added wherever an additional dynamo is placed.

A NOTICEABLE IMPROVEMENT is the large number of explanatory cards that are to be found in nearly all the exhibits, enabling the visitor to determine the precise use for which the respective article may be designed for, and thus creating an intelligent interest. The various exhibitors contemplate giving a banquet on the closing night, and making it the prominent social feature of the occasion.

THE AMERICAN LEATHER LINK-BELT COMPANY, of New York, have a neat display of link belting, and show belts of various sizes.

C. W. HAZELTINE, of St. Louis, is covering the northern and eastern territory in the interests of the Parker Russell Mining and Manufacturing Company, of St. Louis.

E. C. JAMES is looking after the interests of the Stilwell & Bierce Manufacturing Company, of Dayton, O., at the St. Louis Exposition.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, Oct. 12, 1889.

Mr. A. B. Chandler had his silver wedding Oct. 11.

W. H. Gordon, 115 Broadway, has just opened salerooms and New York agency for Wirt's voltmeters, standard test instruments, Ellis oil filters, Fletcher's specialties and the Simplex wires, etc.

Mr. R. E. Gallaher, the genial Secretary of the New York Insulated Wire Company, has taken unto himself a wife, Miss Belle Thomas, of New York. They are spending their honeymoon at Old Point Comfort. I join with their many friends in congratulations.

Woodbridge & Turner, the electrical engineers, of 74 Cortlandt street, this city, have under construction the Eighth street line of the Wilmington City Passenger Railway and the construction of the new Jamaica, L. I., road, both on the Sprague system. The re-constructed Jamaica road is some seven miles long, one-half of which is double track. It is to be completed on the 18th of the present month.

Nickel-in-the-Slot Telephony.—The Brooklyn *Standard-Union* says: "An entire novelty on the line of the 'nickel-in-the-slot' machines, which will shortly be introduced on all the elevated railroad stations and in the various ferry houses and other public places, is no less an invention than an automatic telephone. The machine will be so contrived that by the insertion of a penny in the outer slot the door shielding the 'phone' can be opened, and by the introduction in an inner slot of a dime, quarter or a half dollar, the central office can be notified and communication obtained with parties in or out of the city."

Augustus Noll & Co., 10 and 12 East Sixteenth street, New York, the electric light contractors, are putting in the plant at the Museum buildings, Central Park, for which they secured the contract for dynamos, engines, wiring, etc. They have been also finishing up the Hotel Marlborough, Thirty-sixth street and Broadway, where 400 lights of the Manhattan system are installed. They have just completed 1,600 lights at Macy's, Fourteenth street and Sixth avenue, Manhattan system; Sonneborn Hotel, 400 lamps, same system; Church of the Holy Innocents, 600 lamps; Temple Emanuel, 800 lights; Harlem Club, 1,000 lights; Harlem Museum, 150, and many others.

Hazazer & Stanley, 32 Frankfort street, are working their force of 72 men night and day in their factory and on outside work. They are fitting up the magnificent house of Col. McAlpine, the tobacco manufacturer, New York, with wires for annunciators, burglar alarms, gas and electric lighting, the wires running from the house to the street, where they put down 600 feet of the Bishop Gutta Percha Company's cable in the National Conduit system of subways. They are wiring a handsome residence for John Dwight, of New York, also Anson Phelps Stokes' house. They have fitted up John Arbuckle's house with every conceivable household specialty, and also Mr. Brown's, of Far Rockaway. They report the bell business booming.

Standard Underground Cable Company.—The other day I dropped in to see Mr. Wiley, of the Standard Underground Cable Company, 18 Cortlandt St. I found him at the telephone—as he usually is when I call—receiving an order for 2,000 feet of numerous conductor No. 18 lead cable. As he left the telephone to greet me the postman came in with an order for 16,000 feet of Nos. 6, 8 and 10. Mr. Wiley got the order from the Board of Education, consisting of lead-covered cables, 1, 2 and 3 conductors of No. 14 gauge, amounting to $6,500. The Fire Department of New York presented him with their big order for $40,000 worth of lead cables, No. 14 wire, in cables of from 6 to 36 conductors, which he commenced to lay Oct. 4. His company have furnished 50 miles of Nos. 0000 to 4 lead-covered cable to one company alone, which is now in use in the subways, and also 28 miles to other companies. All of this cable is giving the greatest satisfaction.

Messrs. E. Gould & Eberhardt. 87-111 N. J. R. R. avenue, Newark, N. J., the extensive manufacturers of machine tools, lathes, planes, gear cutters, etc., have an exhibit at the Paris Exposition of which any American firm might well feel proud. Their gear cutters are being manufactured by Messrs. Heilman, Ducommun, Steinlen & Co., Mulhouse, Alsace, one of the largest houses in France (and as important there as our Brown & Sharpe, Pratt & Whitney, etc., here), under the patents of M. & H. E. Eberhardt, of E. Gould & Eberhardt, who are exhibiting them in practical operation, cutting bevel and spur gear. The great feature about these cutters is that they can be set to cut bevel or spur gear, and will cut all the teeth in a gear wheel without any attention from the operator whatever, after once being set. When the teeth are all cut a bell will ring automatically, calling attention to the fact that the teeth are completed. They have had these machines in operation for years without any variation. This is a very valuable machine for all manufacturers of electrical apparatus of all kinds dependent on mechanism.

The Van Gestel Electric Street Railway Car Company is the name of a new company, 510-514 West Fourteenth street, New York. I called there and met Mr. Van Gestel, who is the manager and electrician, This name is familiar to the minds of all early storage battery people, as Mr. Van Gestel has been experimenting since 1861. He escorted me through the works. On the second floor he is building a motor car which will draw one or more cars; the motor proper is of the Gramme laminated armature type. The field magnets form a double horseshoe around the armature, which is fitted with two commutators so as to run in either direction. Friction clutches will be attached to the forward and rear axles, operated from inside the car and arranged so that either set of friction clutches can be operated as desired. The interior of the motor car will have three shelves around it, containing the storage cells, leaving room in the centre for the operator. The cells are composed of lead plate with alternate V sections on either side, with extensions of lead which can be closed together over the dry oxide pencils when placed in the sections and sewn to hold them in place; and contact is made through interstices left at the edge of the lapped lead extensions. The officers of the company are Mr. H. M. Munsell, president, and Mr. J. A. Browne, secretary, both prominent business men in this city; and a meeting was about to be held to elect new officers when I left.

The Bergmann Electric and Gas Fixture Company have broken ground for a new building, which is to be 75 × 100 feet, next to their present large building, which is 75 × 75 feet. They have already put up and completed a large building, 75 × 100 feet, on the northeast side of their main building. All these buildings are six stories high, with the exception of the main building, which is seven, and are fitted out with all the latest improved machinery for the manufacture of electric and gas fixtures. One great improvement and novel feature is that the foundry and casting room is located on the top floor of the main building, occupying the whole floor. The north section is devoted to tools, telegraph instruments, stock tickers, etc. They are now manufacturing the perforators for the Wheatstone system, which until now were always built by Elliott Brothers, of London, and have made great improvements on them. They are also building the motors for the Gold and Stock system, and constructing Lieutenant Patten's new multiplex system, also the Delany synchronous system. For some of their fixtures they cast hollow floral filagree brass composition balls all in one piece, which is a very important feature. Some beautiful castings were shown me, all new and original designs, devised by Mr. Caldwell, one of the finest designers in the country, who was formerly connected with the Archer & Pancoast Company for a number of years. They employ over 300 hands, although their original building has only been open since March 1, 1889. One great feature in having the foundry on the top floor is that all fumes from the moulds can pass up through the roof, where a sliding door is provided for the purpose. The castings come out of the moulds clean and distinct, saving much time and labor, and Mr. Bergmann is very proud of his men in this department. The iron-working department is in the north section, where they are turning out some very fine and original work in fixtures, all forged. I saw a grand fixture under construction as I was being courteously escorted through these works by Mr. Sigmund Bergmann, the president. A large force of modelers in plaster of paris were actively engaged preparing some rich designs from drawings on the second floor of the main building. The other floors are devoted to buffing, polishing, spinning, etc. The main offices are located on the same floor. Pratt & Whitney's, E. E. Garvin Sons', etc., screw machinery is used on the second floor of the north section. On the first floor is the hammered and chased work. The plating department is situated in a special new building on the northwest section of the main building, using the Zucker & Levett plating machine.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, Oct. 12th, 1889.

Salem, Mass.—The Salem Electric Lighting Company have declared a quarterly dividend of one per cent.

Callers at this Office.—Mr. H. D. Stanley, of Bridgeport, and Mr. C. O. Baker, Jr., of Newark, N. J.

New Bedford, Mass.—The Electric Light Company, of this city, are putting in an additional engine of 200 h. p.

Pittsfield, Mass.—The new Tillotson Mill, near Silver Lake, Pittsfield, will be lit by 200 incandescent lights, of the Mather system.

Stoneham, Mass.—The Stoneham Electric Light Company has increased its capacity by the purchase of another alternating dynamo.

Peabody, Mass.—The Brush Electric Company have petitioned for permission to locate a plant in this city, and a hearing will be given on Oct. 15.

Fall River, Mass.—The Edison Electric Illuminating Company, of this city, recently built an addition to their plant, and are now busily engaged in installing the new machinery.

Salem, Mass.—A petition signed by 70 business men and residents of Salem was presented to the Board of Aldermen, asking that a location for the Essex Electric Street Railway be granted.

Standard Electric Company of Vermont have sold this week a 200-light plant to the Boston & Maine Railroad Company, Northern Division, for their shops at Lyndonville, Vt., and a 150-light plant to the Henry C. Bowen Company, Providence, R. I.

K. W. Cut-outs.—That these ingenious cut-outs are meeting with deserved success may be gathered from the fact that Pettingell, Andrews & Co., of this city, to meet the enormous demand, have just ordered from the Empire China Works, Brooklyn, N. Y., 5,000 porcelain parts.

The New England Electric Company report the sale of the following Sprague motors: Batchelder & Lincoln, Boston, 25 h. p. motor; Boston Bank Note and Lithographing Company, Boston, 10 h. p. motor; Augustus Lowell, 20 h. p. motor; Enterprise Publishing Company, Brockton, Mass., 20 h. p. motor.

Mr. Robert Coleman, well known among electric light, telegraph and telephone men as a strong advocate of "indurated fibre pipe," was a caller at this office this week. He reports business brisk in his line, and appears to have great faith that indurated fibre is fast becoming the popular material for underground conduits.

The Thomson Electric Welding Company, in order to protect themselves, have requested every man in their employ to sign an agreement to assign any patents they may obtain to the company, the men receiving an ample and substantial recompense for such devices as they may be able to develop and perfect. With the exception of four or five all the men signed.

Mr. H. C. Hawks has been appointed New England manager of the Marr Construction Company, of Pittsburgh, in place of Mr. Norman Marshall, who has retired to assume the new position of general district engineer for the New England office of the Westinghouse Electric Company. Mr. Hawks has been connected with the Marr Company for the past two years in various capacities, and brings a varied training to bear in his new sphere of work.

Central Incandescent Plants.—The Thomson-Houston Company reports the following sales of incandescent apparatus to local companies: West Superior, Wis., 1,300; Westboro, Mass., 650; Boston, Mass., 500; Waterbury, Conn., 1,000; Lowell, Mass., 1,000; Altoona, Pa., 1,000; Amherst, Mass., 850; Germantown, Pa., 3,250; Brooklyn, N.Y. (Municipal Co.), 1,300; Jersey City, N. J., 1,300; Hudson, Mass., 650; Norwalk, Conn., 650; Lebanon, Ky., 300; Newton, Mass., 1,000; South Framingham, Mass., 500; Eastport, Me., 500.

The Thomson-Houston Company reports the following sales of arc apparatus: New London, Conn., 30 lamps; Youngstown, Ohio, 50; Erie, Pa.; 30; Van Wort, Ohio, 50; Bethlehem, Pa., 50; Montpelier, Vt., 50; Rockville, Conn., 110; Columbus, Ohio, 150; Nashua, N. H., 50; St. Joseph, Mo., 50; New Bedford, Mass., 50; Vincennes, Ind., 30; Covington, Ky., 35; Joliet, Ill., 100; Waycross, Ga., 50; Springfield, Ohio, 50; Passaic, N. J., 50; Sioux City, Iowa, 85; Bradford, Pa., 50; Peoria, Ill., 405; Lowell, Mass., 25.

The Walworth Manufacturing Company, of Boston, continue to receive inquiries from all parts of the States for their specially constructed steel and iron poles for electric railways and electric lamps. They have had a tremendous run on these poles and have hard work keeping abreast of their numerous orders. Inquiries are coming in from England, and South America is also making a call for them. The poles are neat and graceful, and it is safe to say that every city will soon learn to appreciate them and order them in preference to the more primitive wooden poles.

Cut Down the "Dead Wires."—Another accident which very nearly resulted in the death of four boys has just been reported. A dead wire, said to belong to the Western Union Telegraph Company, hanging from a pole, had attracted the attention of the boys, and they had all taken hold of the line for the purpose of swinging in it. While swinging, the wire came in contact with an electric light wire, and the boys were unable to let go. They were at last extricated from their dangerous position by a patrolman, and taken to the Massachusetts General Hospital. The flesh on the hands of each boy was found burned completely off to the bone.

The Thomson-Houston Electric Company.—The stockholders of the Thomson-Houston Company held a special meeting at New Britain, Conn., this week, and increased the capital stock from $3,000,000 to $4,500,000, divided into 180,000 shares of the par value of $25 each. The stockholders also decided to change the place of holding meetings from New Britain, Conn., to Middletown, Conn. The Thomson-Houston directors have voted a dividend out of the net profits, payable to holders of the common stock of record Oct. 5, and payable by a distribution of certain assets of the company. These assets have been set apart in the hands of three trustees, to be disposed of from time to time for the benefit of the holders of these certificates.

The Thomson-Houston Company reports the following sales of incandescent apparatus for isolated plants: Central Union Depot, Cincinnati, O., 200 arc; Bellair Nail Works, Bellair, O. 50 arc; Baugh & Sons, Philadelphia, Pa., 50 arc; S. L. Allen & Co., North Pennsylvania Junction, 400 incandescent; John C. Holmes & Co., Springfield, Ill., 100 incandescent; Clark & Milliken, Richmond, Me., 50 incandescent; Ray Woolen Mills, Franklin, Mass., 250 incandescent; Diamond Match Works, Westville, Conn., 50 incandescent; C. I. Hood & Co., Lowell, Mass., 300 incandescent; Cornell Mills, Fall River, Mass., 800 incandescent; Roberts Iron Works, Cambridge, Mass., 50 incandescent; Knowles' Loom Works, Worcester, Mass., 45 arc; Portland Steam Packet Company, Portland, Me., 300 incandescent; Hopedale Elastic Fabric Co., Hopedale, Mass., 400 incandescent; Sheffield Worsted Company, Pascoe, R. I., 300 incandescent; A. L. Sales, Pascoe, R. I., 50 arc.

The Jarvis Engineering Company, of Boston, Mass., are selling a large number of Armington & Sims engines. Among their recent orders are two of 235 h. p. to the Edison Electric Illuminating Company, of Boston, making seven of this size they have sold this company within six months. They report the following recent sales: One 50 h. p. to C. I. Hood & Co., Lowell, Mass.; one of 35 h. p. to Ray Woolen Company, Franklin, Mass.; one of 80 h. p. to Great Barrington Electric Light Company, Great Barrington.; one of 90 h. p. to Marlborough Electric Light Company, Marlborough, Mass.; two of 100 h. p. each to Dedham Electric Company, Dedham, Mass.; one of 70 h. p. to Louisiana Sugar Refining Company, New Orleans, La.; one of 100 h. p. to Westboro Electric Light and Power Company, Westboro, Mass.; one of 50 h. p. to Bennett Manufacturing Company, New Bedford, Mass.; one of 100 h. p. to Bennington Electric Light and Power Company, Bennington, Vt.; one of 100 h. p. to Hoosick Falls Electric Light and Power Company, Hoosick Falls, N. Y.; one of 125 h. p. to Edison Electric Illuminating Company, Fall River, Mass.; one of 100 h. p. to Leominster Electric Light Company, Leominster, Mass. The Jarvis Engineering Company are making large sales of their other specialties, Sheffield grate bars, National feed water heaters, Korting injectors, etc.

A. C. S.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, Oct. 12, 1889.

George Cutler, Chicago, is making 3,500 porcelain fuse boxes for a customer.

The De Pere, Wis., Land and Water Company will install an electric light plant at once.

The Allegheny Electric Light plant will be placed on Martin street, adjoining the Hope engine house.

E. G. Felthousen, of the Buffalo, N. Y., Steam Pump Company, visited Chicago and St. Louis during the week.

Dr. Leo Rassieur, of St. Louis, has taken a one-third interest in the Union Electrical Construction Company of that city.

John H. Finney, of the Fidelity Carbon Company, St. Louis, recently made a successful business trip through several of the middle States.

The Rose Electric Light Supply Company, St. Louis, recently purchased and sold, as second hand, within 24 hours, an entire electric light plant.

W. T. M. Mottram, Dallas, Tex., has closed a contract with the Rapid Transit Railway Company, of that city, for the installation of the Sprague electric railway system.

The Superior, Wis., Water, Light and Power Company has been duly incorporated with a capital stock of $1,000,000, by Frank A. Ross, William D. Dwyer, and William R. Fanning.

Mr. G. Pantaleoni, general district agent of the Westinghouse interests at St. Louis, has lately closed various contracts for alternating incandescent apparatus aggregating some 9,200 lamps.

The Southern Electrical Supply Company, St. Louis, Mo., have made special arrangements regarding the manufacture of incandescent lamps, enabling them to furnish on receipt of order lamps in any quantity and for any voltage.

Frank P. Mack, manager of the Chicago office of the Underwood Manufacturing Company, has placed 200 feet of 12-inch cotton leather belts in the *Pioneer Press* building at St. Paul, Minn., to connect the Mather dynamos to pulleys.

The Rockford, Ill., Street Railway Company was sold to a syndicate of Chicago capitalists for about $35,000. Ten thousand dollars will be put in an electric line and more road built. It

is said that Holmes, the street railway millionaire, is back of the deal.

Walter F. Smith, of Philadelphia, has been elected general manager of Heisler Electric Light Company, and will make his headquarters in St. Louis. Mr. Smith will no doubt make many sales with the aid of that hearty grasp of the hand and warm welcome extended to all callers.

The Central Electric Company, Chicago, have kindly presented the Western office of THE ELECTRICAL WORLD with a neatly framed photograph showing the armoring room in the Okonite Company's factory. The Central Electric Company, Chicago, received on last Friday orders for okonite wires aggregating 130 miles.

W. G. Halm, Manager of the Chicago office of the Perkins Electric Lamp Company, recently closed several large contracts for the Perkins lamp, among the number being one for 10,000 of 16 c. p. Mr. Halm now has on hand, ready for immediate shipment, a large stock of lamps designed for currents ranging in potential from 44 volts to 131 volts.

The Association of Stationary Engineers of Cincinnati have prepared the following course of lectures for their weekly meetings during the first half of the winter. One of the early lectures of the course is one by Mr. J. Hauss, of the Hauss Electric Light and Power Company, on "Electricity." On Nov. 12, Prof. T. French, Jr., of McMicken University, is to take up the same subject.

The Texas Pacific Railway Company operate a special system of switch signals in the union yards, at Marshall, Tex., employing semaphores controlled by electro-magnets. At the entrance are placed two 12-inch bull's-eye lanterns, each containing two 25-c. p. incandescent lamps, while 16-c. p. lamps have been placed at various points throughout the yards, the current for the entire system being furnished from the Westinghouse alternating plant at Marshall. Mr. J. H. Gates, of Dallas, made the installation.

J. H. Gates, general district agent of the Westinghouse interests at Dallas, Tex., has recently sold a 750-light alternating incandescent plant and Westinghouse engine to the Victoria, Tex., Power, Light and Ice Company; also an additional 750-light alternating plant to the Houston, Tex., Electric Light Company, and 1,500 additional lights to the Little Rock, Ark., Gas Company. In direct current incandescent apparatus, Mr. Gates has sold 300 lights to the Cunningham, Tex. Sugar Mill Company and 300 lights to the Cotton Oil Mill at Houston, Tex.

Theodore P. Bailey, manager of the railway department of the Thomson-Houston Electric Company, closed a contract this week for equipping the Union Depot Street Car Line, in St. Louis, with the Thomson-Houston system and to have the same in operation by Jan. 15. Mr. Bailey states that this line will be the best equipped line in the country, the thirty cars to contain every modern device that will add to the comfort of the passengers. The steam plant will be of over 700 h. p., and six 80 h. p. generators will be placed in service at the start. Mr. Bailey further states that a second increase at Des Moines, Iowa, has been ordered, of six 30 h. p. cars complete and two 80 h. p. generators.

The Thomson-Houston Electric Light Company have sold through their Chicago office during the past three weeks the following electric light apparatus, aggregating 800 arc lights, 1,600 direct incandescent, and 5,400 alternating incandescent lights. Arc lights: Jenney Electric Light and Power Company, Peoria, Ill., 405; Fremont Electric Light and Power Company, Fremont, Ohio, 50; Edison Light Company, Grand Rapids, Mich., 50; W. A. Hunter, Belle Plain, Ia., 20; Watertown Electric Light Company, Watertown, Wis., 50; Chicago Arc Light and Power Company, Chicago, 50; Ft. Scott Electric Light and Power Company, Ft. Scott, Ky. 70; Peoples' Railway Company, St. Louis, Mo., 6; Mason City Ga. and Electric Light Company, Mason City, Ia., 35; James Wilde, Jr., & Co., Chicago, 12. Direct current incandescent lights: Girls' Reform School, Mitchell, Ia,, 150; Hall & Buell, South Manistique, Mich., 75; Bonsfield & Co., Bay City, Mich., 150; Conway Cabinet Company, Milwaukee, Wis., 150; People's Railway Company, St. Louis, Mo., 6; Mason City Gas and Electric Light Company, Mason City, Ia , 35; H. R. Jacobs, Chicago, 500; Texas Blind Asylum, Austin, Texas, 100; Theo. Zschetzsche & Son, Sheboygan, Wis., 150. Alternating incandescent lights: Jenney Electric Light and Power Company, Watertown, Wis., 1,300; Watertown Electric Light Company, Watertown, Wis., 650; Town of Hope, Ark., 300; Springside Coal Mining Company, Pana, Ill., 650; Cicero Water Gas and Electric Light Company, Cicero, Ill., 1,950; Armour & Cudaby Packing Company, South Omaha, Neb., 650. F. DE L.

ENGLISH NOTES.

[*From Our Own Correspondent*.]

LONDON, Sept. 4, 1889.

The Electric Launch "Eta."—One of Messrs. Immisch & Co.'s electric launches, the "Eta," made a run up to Oxford and back the other day and attracted considerable notice at the old university town. One run of 60 miles was made without re-charging; the total run out and home was 160 miles, performed in a leisurely manner in five days, the accumulators being re-charged at Messrs. Immisch's floating stations.

The Halifax-Bermuda Cable.—The statutory general meeting of the Halifax-Bermuda Cable Company was held last week, and the shareholders were treated to a very sanguine speech from the chairman, Sir Alexander Armstrong, who anticipates that the cable will be shipped and laid before the end of the present year. This company, it will be remembered, enjoys a handsome subsidy from government, the *raison d'etre* of the cable being mainly strategical. I notice, however, that the chairman anticipates that American and Canadian business men, who use the island as a health resort, will help to fill the company's coffers, and that he also counts on an appreciable revenue from telegrams in connection with our meteorological service. The cable, I may add, is to be landed at either end under the guns of the forts.

The Underground Main Operations in London.—The inhabitants of the metropolis are proverbially long suffering; but even their patience it would appear is exhausted by a five weeks' block of one of our narrowest and liveliest thoroughfares—the Strand. This street has been the scene of the main-laying operations of several electric lighting companies, and owing to one cause and another, such as the failure of the supply of paving material, due to the dock strike, considerably over a month elapsed before traffic could be renewed. The consequence has been that the British public has given vent to its indignation by writing long letters to the *Times* and libelling the local authority. On Monday the local surveyor published his rebutter, and the particulars he gives as to the network of pipes to be contended with enable us to fully realize the difficulties of the question. The obvious solution seems to be a substantial subway into which all the mains could be put; but as this would apparently involve an alteration in the present level of the main sewer the subway solution is not without its drawbacks.

Paddington and the Electric Light.—The Paddington Vestry, whose jurisdiction extends over an area comprising a population of considerably more than 100,000 inhabitants, is about to discuss the third report on the subject of electric lighting which has been presented to it within the last twelve months. In September last year, a Mr. S. J. Mackie drew up an estimate of the cost and probable profit of a central lighting station, and worked out the handsome return of 37 or 50 per cent., based on a total annual output of 2,186 hours under full load. In April of this year, the Vestry, not content apparently with report No. 1, secured the services of Prof. George Forbes, who carefully considered the questions of cost, profit and system. The report now about to be considered is that of an Electric Lighting Committee, who recommend that the work should be entrusted to a good company, and that the storage battery sub-station system should be adopted. Something more tangible than reports may now be expected, since the Vestry have only prevented their large district from being allotted to private companies upon the tacit understanding that they would move in the matter themselves.

The Danger of Electricity.—Probably no one is more astonished than Mr. Preece at the stir created both in the London and New York daily press by a few remarks made by him last week at the British Association as to harmlessness, when the proper precautions are taken, of the electric current. One of the results has been a challenge, after the style of Mr. Harold P. Brown, from a Brighton doctor, to "lay hold of a 2,000-volt electric wire." Mr. Preece did not say that the use of alternate currents of high pressure was without any attendant dangers, nor that the wires conveying such currents might be handled with impunity; nor that deaths due to shocks received from electric light wires had been found on investigation to be nonsense. But in reply to a mining engineer who opposed the introduction of electricity into mines for power purposes because a man who touched the conductors would be killed, Mr. Preece *did* say that in view of the fact that up to the present low-tension direct currents had invariably been employed in mines, such an assertion *was* absolute nonsense. He further asserted, with perfect truth, that many deaths were attributed to electricity with which it had nothing to do, and that as regards electrical execution, it was impossible with our present knowledge, to make death by electricity an absolute and painless certainty. As Mr. Preece remarks in a letter to the *Times*, it is somewhat surprising that he, of all persons, should be accused of underrating the dangers of electricity, considering the very active part taken by him in the framing of various rules and regulations for the safety of life and property.

(*From Our Special Correspondent.*)

EDINBURGH, Sept. 15, 1889.

Lighting in Edinburgh.—Leaving Newcastle for Edinburgh I expected to find a better appreciation of electricity in this beautiful city, but was again destined to disappointment. The only arc lighting to be seen here is at the station of the Great Eastern Railway, which is lighted by Brush lamps installed by the Brush Electrical Engineering Company, Limited, who have a branch office here. There is not another arc lamp outside of this in the place, but the Brush Company have an incandescent plant in the Conservative Club and the Lyceum Theatre. They also light up a number of mills and engineering works in neighboring towns. A central electric light station has been contemplated by the Brush Company for some time, but the promoters of the scheme have to battle against the hard fact that the city owns the gas plant, which it was induced to acquire at a price which nets the original shareholders 10 per cent. on their investment. So that between the natural shyness of the city fathers and their fear of hurting the city's income from gas, the electric lighting plant seems a long way off.

An Electrical Exhibition.—The condition of affairs respecting electrical application in other parts of Scotland is very much the same as that obtaining in Edinburgh. I was, therefore, glad to learn that next year it is proposed to hold an International Exhibition o Electrical Engineering, General Inventions and Industries in Edinburgh. The arrangements are already well under way, and Mr. A. R. Bennett is taking an active part in the undertaking. A site of 90 acres has been obtained at Merchiston, within easy walking distance of the centre of the city, and plans have been prepared for the necessary buildings, so that the exhibition may be opened early next May. A special feature will be the provision of a lecture hall, in which, during the exhibition, a course of popular lectures on the principal exhibits and inventions will be delivered. The hall will likewise serve for the special meetings of the Institution of Electrical Engineers, the Société Internationale des Electriciens, and other scientific bodies, which it is expected will be arranged for in connection with the Exhibition. America ought to be represented here, and it is to be hoped that some of our leading companies may see their way clear to making an exhibit next spring.

Absence of Electric Lights.—The traveler in crossing the American continent cannot fail at night to learn the approach of the train to inhabited places from the glare of the electric lights, which he sees for miles long before coming to a town; and, as has been pointed out, this glare has often been used to good account by river pilots to guide them, especially in thick weather. There is a very different condition of affairs on this side of the water. Excepting in a very few cases, outside of London there is very little public electric lighting done, and even that for the most part is by the incandescent lamp. Newcastle, where the British Association met, is, I understand, soon to have an electric light station started on a small scale, but the leads will have to be underground. During the Newcastle meeting Prof. Sylvanus P. Thompson delivered a lecture on "Polarized Light," and the current to operate the arc lamp in the lantern employed was obtained from the plant of the Co-operative Society, close by, no public lighting wire being in existence.

One of the most striking examples of conservatism, not to say lack of appreciation of the benefits to be derived from an electric light, was that which I had occasion to note during a visit to the great ordnance and shipbuilding works of Sir Wm. Armstrong, Mitchell & Co., at Newcastle. These works employ over 13,000 men and have been running day and night continuously for considerably more than ten years past. Up to within a short time ago the light at night was furnished by gas from gas works attached to the works, but recently these have been removed to make room for additional machine shops required, and the gas is now supplied from the city works. Considering the exacting nature of the work carried on here, the continuance of gas as an illuminant strikes one a very peculiar. A combined arc and incandescent plant would be a great improvement and would certainly pay for itself in an increased amount of, and better, night work accomplished. Undoubtedly the low price of gas may account for its continued use, but I think some of the English electric lighting firms might induce Lord Armstrong to give the electric light a trial, and once introduced, I am certain of its adoption for the whole works.

The Development of Telephony.—Having thus little to occupy me in the way of lighting, I turned my attention to telephony, and was most courteously received by Mr. A. R. Bennett, the general manager of the National Telephone Company, whose excellent work in the field of telephony has on more than one occasion been brought to the attention of your readers. Edinburgh, with over three hundred thousand inhabitants, has but little over 700 subscribers. This comparatively small number is, however, not by any means due to any lack of enterprise, or to the poor quality of service furnished by the company, but to a combination of circumstances of which we in the United States can hardly conceive. In the first place, no pole lines are permitted, and the wires are all strung on poles supported on the roofs of houses, the consent of the owners of which must be obtained for the stringing of wires over them. Now, in many instances the wires pass over houses inhabited by tenants, each one of whom owns a floor or part of a floor of the house. They all, however, hold the roof in common according to law, and as a result, in some instances six or seven permits have to be obtained to run a wire over a single house. Not infrequently it happens that five of the tenants consent, and the last refuses, with the result that the route has to be changed, or the "kicker" bought off. Owing to this fact the telephone company has been obliged to distribute even its comparatively small number of subscribers over six small exchanges, averaging about a hundred subscribers each, a plan necessitated solely by the facts mentioned. I remarked above that there were no pole lines in the streets, and the manner in which the lines are run commands the warmest admiration. The standards fixed to the roofs consist of wrought-iron posts fixed in cast-iron bases. The cross arms are of wrought iron consisting of two small channel bars, which are bolted together and shaped so as to embrace the wrought-iron standard, and with smaller spaces for the insertion of the insulator pin. These cross arms as a rule carry four wires fixed to porcelain insulators. The latter are of a special form and coated with a brown colored glaze. The wires employed are of silicon bronze, No. 18 B. W. G., and hence, while acting as good conductors, permit of spans of over 250 yards with comparatively little sag; their small size also makes the lines obtrude very little on the view, and indeed, unless attention were called to them, they would scarcely be noticed. Within the city the single wire with earth return is employed, but the trunk lines between outlying towns are all double wire metallic circuits. This, of course, requires repeating coils at the exchanges, and those employed are the invention of Mr. Bennett, who holds the patents on them for Great Britain. What makes the running of the wires on the roofs in Edinburgh still more onerous is the fact that the majority of the houses have gable roofs with pretty stiff inclines, and linemen are often placed in very dangerous positions. Considering all these facts, the neat and substantial appearance of the overhead work leads one irresistibly to the conclusion that much of the clamor against overhead wires heard nowadays would have no *raison d' etre* if the plan here adopted were generally followed.

WETZLER.

BIRMINGHAM, Sept. 18, 1889.

A Visit to Elwell-Parker.—Being at Birmingham, I took the opportunity of running down to Wolverhampton, where the works of Elwell-Parker, Limited, now merged into the Electric Construction Corporation, Limited, are situated. Mr. J. Parker kindly showed me over the works, which employ between 500 and 600 men, and I was rather surprised to observe the great state of activity in all the departments, considering the little lighting I had yet seen in England. The works are now busy on a number of alternating machines for one of the London companies, and several are building for Australia. The new standard type of continuous current dynamo built here is a well-designed machine, and I shall be able to give your readers more particulars at no distant date.

Electric Railroading.—Some time ago one of the Birmingham tramway companies which employ steam motors, contemplating a change to electricity, instituted experiments with a Julien storage car. The result proved so satisfactory that now twelve cars of a modified type have been ordered, which are being built at the Elwell-Parker works. The motor will rest on a bogie truck, and is geared by means of a countershaft to both pairs of wheels, spiral spur gearing being employed. The motor is placed in a steel frame, and is centred on one of the axles. The new cars will have capacity for 48 passengers, and will carry 72 cells of 230 ampère-hours' capacity. The car is designed to run at eight miles an hour, the motor being designed for a normal output of 11 h. p., at which it takes 60 ampères of current.

The Show at Birmingham.—I left Edinburgh more in sorrow than in scorn at the backward state of electric lighting, expecting to find matters better in the large manufacturing district, of which Birmingham forms the centre. I was doomed to disappointment, however, for here, again, there is practically no electric lighting done whatever. This statement, however, needs some modification for the moment, in view of the Electrical and Industrial Exhibition now in progress here, and which ought to open the eyes of the natives to the possibilities of electricity. The Exhibition is being held in Bingley Hall, and while largely industrial in its nature, contains an example of almost every system of electric lighting now employed, together with many examples of electric motor work. Thus there is shown the Mordey alternating system of the Brush Electrical Engineering Company, Limited. The Mordey alternating machine is already familiar to your readers, having been described in THE ELECTRICAL WORLD. One of these machines of 25,000 watts' capacity is arranged to supply current for driving a second similar alternating machine as a motor, which, in turn, drives a Victoria compound dynamo, which supplies current for three 5-ampère arc lamps and a number of incandescent lamps. During my visit, however, the dynamo was only supplying current for lamps direct from the converters. A Brush arc machine furnishes all the lights for the machinery hall and eight arc lamps are also run from the alternating current circuit, each taking 12.5 ampères at 40 volts. The Brush lamp is used for this purpose, with some slight modifications, such as the lamination of the magnet cores. There is also exhibited a continuous current meter, the details of which I was not permitted to learn. Elwell-Parker, Limited, of Wolverhampton, exhibit a number of machines for lighting and plating, and have a small storage battery station in operation. Messrs. Laurence, Paris & Scott, Limited, of Norwich, have quite a creditable show of dynamos and motors, a number of which, situated in various parts of the building, drive a press, an 18-inch circular saw, ventilating fan and other machinery. I noticed a simple starting arrangement on their constant speed motors, which works very satisfactorily. The motors are shunt wound, as usual, but have an additional coil in series with the armature. A simple pivoted bar magnet acting against a spring is placed in proximity to the magnets and operates a switch contact. When no current is on the machine, the spring pulls the bar magnet away from the field which puts the series coil in circuit with the armature. The current, when thus put on, immediately magnetizes the field and starts the machine. As soon as the speed increases and the counter E. M. F. increases, the field magnets also increase in strength, and, attracting the switch magnet, cut the series coil out of circuit, so that the motor continues to operate as a pure shunt machine. I am aware that this particular method of starting is not new, but the simplicity of the means employed, avoiding all rheostats, is worthy of note. Of course, no electrical exhibition can nowadays be considered complete without Prof. Elihu Thomson's electric welding apparatus, and it is here

being exhibited under the auspices of Messrs. Laing, Wharton & Down, of London. The apparatus is in charge of Mr. Fish, who also had charge of it at the American Institute Electrical Exhibition in 1887. Besides the welding machine, however, Messrs. Laing, Wharton and Down, who are the agents for the Thomson-Houston apparatus in England, exhibit either in substance or in photographs the large variety of Thomson-Houston products. I may add that the building is lighted by Thomson-Houston arc lamps from a dynamo in machinery hall, which also supplies current for a few street lights operated during the continuance of the exhibition. Among the other exhibits I noted those of the Edison and Swan United Electric Light Company, which consists of various styles of incandescent lamps; Woodhouse & Rawson, Limited, show a large variety of their well-known manufactures; Messrs. Immisch & Co. have on exhibition a number of their useful motors, which show excellent design and workmanship. I must also mention the exhibit of *Electrical Plant*. This enterprising journal has a neat little booth, and has already published a number of illustrated supplements on the exhibition which will afford attractive reading for the inhabitants of Birmingham, as the editor has very ingeniously mixed fact and fun in his descriptive articles. C. & C. motors are also shown, together with the Woodward battery, by Messrs. Shippey Bros. I must not forget to mention the operation of a telpher passenger line in connection with the exhibition. The line is erected in the gallery of the summer-garden annex, and has a total length of about 350 feet. The train is driven by a Statter motor, and the cars suspended from a wire cable. I took a ride on the train, and from the experience gained am led to the conclusion that the wire-rope method of suspension will hardly become popular for passenger traffic. While crudely constructed, the system works quite well, and shows what can be done in the way of transportation facilities with small outlay for roadway. Finally, I must not forget to mention the exhibit of Messrs. Crompton & Co., which attracts considerable attention, owing to the presence of their electric crane, which was described and illustrated in THE ELECTRICAL WORLD some months ago, and which is capable of effecting three movements simultaneously if required.

WETZLER.

RUSSIAN NOTES.

Moscow, Sept. 15, 1889.

Telephone Extension.—The Ministry of Posts and Telegraphs proposes to organize a new telephone service between Moscow and St. Petersburg, a distance of 400 miles. The expenditure necessary will amount to about $50,000.

A New Battery.—It is reported that a Russian technologist named Ezoroff has invented a battery, more efficient than the Leclanché, and of simpler construction. One special feature is its normal dryness, owing to which, it is said, it can be used to advantage in hot as well as cold climates.

Edison's Inventions.—I hear that Mr. Koretofsky has recently made a contract by which he secures the right to organize within Russian Territory an exhibition of all the various Edison inventions. Mr. Koretofsky has the backing of capital and is already preparing to make his first exhibition, following plans made by Mr. Edison. The exhibition referred to will be opened at Warsaw about the middle of November. A hall has already been rented. The exhibition will last several months. P.

THE TELEGRAPH.

Buffalo, N. Y.—The Western Union Company, under pressure from the city, through the courts, is beginning to bury its wires.

The American Rapid Telegraph Company is defendant in a suit at Hartford, Conn., by the Boston Safe Deposit and Trust Company, for $3,000,000 of bonds on which interest has been defaulted. Foreclosure and sale is asked.

The New York Telegraph Operators will give an entertainment in the New Central Opera House at 205 East Sixty-seventh street, on Thursday evening, Oct. 31. They will give a short musical and literary entertainment, present Robertson's comedy "Caste," and hold a reception afterward.

THE TELEPHONE.

Louisville, Ky.—The Ohio Valley Telephone Company will put their wires underground, and have let the contract for furnishing conduits to P. Bannon & Co.

The Yazoo Valley, Miss., Telephone Company has been formed, with a capital stock of $5,000, by J. F. Powell. W. D. Pugh, C. E. Crane and others.

The Pacific Telephone Company has re-organized under the Pacific Telephone and Telegraph Company, which will have a capital of $5,000,000. The directors are: Lloyd Tevis, W. F. Goad, E. S. Pillsbury, W. C. Gibbs and Joseph M. Quay, of San Francisco, and John E. Hudson.

THE ELECTRIC LIGHT.

Attalla, Ala., is likely to have a Thomson-Houston plant.

Hampton, Va.—The Hampton Electric Light and Power Company has been formed.

Jackson, Tenn.—The Citizens' Gas Light Company will increase their electric plant.

Lebanon, Ky.—The Lebanon Electric Light Company will put in a Thomson-Houston plant.

Frostburg, Md.—A company to put in a Westinghouse plant has been formed by W. H. Evans.

Haddonfield, N. J.—The Haddonfield Electric Light Company will begin work at once on its plant.

Murfreesboro, Tenn.—Oslin, Smith & Tally have the work in hand of putting in a plant for the city.

Williamsport, Pa.—The Westinghouse Company has sold 250 Waterhouse arcs for central station use at Williamsport.

Tampa, Fla.—Mr. R. Mugge has contracted for a large central incandescent plant with the Heisler Company of St. Louis.

San Diego, Cal.—Mr. H. E. Xanshowe is corresponding with a view to purchasing a plant for the San Diego Gas Company.

Auburn, Cal.—The Auburn electric light plant is starting up, with power furnished from a Stilwell & Bierce 10-inch turbine.

San Jose, Cal.—The San Jose Electric Light and Power Company is putting in a 1,000-light plant of the Brush alternating system.

The Morris, Ill., Electric Light Company, formed by L. Degen, C. H. Kusel and H. L. Miller, has a capital stock of $5,000.

Helena, Ark.—The Helena Electric Light and Power Company are to put in two incandescent machines, two engines and a boiler this winter.

Ukiah, Cal.—The North Pacific Land Improvement Company will put in an electric light plant at Ukiah, and furnish power for an electric road.

The Fitchburg Steam Engine Company have been running over-time steadily and will soon light up with their own electric lighting plant.

Jackson, Mich.—The electric light plant at Jackson, burning crude petroleum, suffered recently from an explosion which shook up things rather badly.

Hopkinsville, Ky.—An electric light plant, costing about $3,000, will be put in the Western Lunatic Asylum. Mr. B. W. Stone is the superintendent.

The Heisler Electric Lighting System has been awarded a gold medal at the great Paris Exposition, where the Heisler Company had a beautiful exhibit.

The Enterprise Electric Light Company, of Chicago, has been formed by M. T. Griffiths, K. F. Griffiths and A. C. Burdick, with a capital stock of $100,000.

Bissell, Pa.—Stern & Silverman, Edison agents, of Pittsburgh, are erecting an Edison incandescent-light plant for the Novelty Steel Wheel Company at this place.

Fort Worth, Tex.—The Fort Worth Electric Light Company have bought out the Fort Worth Electric Light and Power Company. They also own the gas works.

San Angelo, Tex.—The San Angelo Electric Light Company has been formed by J. W. Hill, W. S. Cunningham, A. McLean and others, with a capital stock of $20,000.

Bonham, Tex.—The Bonham Electric Light Company, who will put in a Heisler plant, have let their machinery contract to Clower & Harris, the energetic electrical engineers of Dallas.

The Walla Walla Gas and Electric Company, California, has been formed by T. Quinn, C. Ennis, H. R. Burford and J. L. Jones, with a capital stock of $100,000, to consolidate existing interests.

The Chemical Electric Light and Motive Power Company has been organized at Camden, N. J., by Thomas E. Van Dyke, Marion Mayne, Michael Kock, William Williams, John R. McLaughlin, H. Woodruff, all of Philadelphia, and Joseph R. Taylor, of Camden, with a paid up capital of $50,000.

Vancouver.—The agreement between the city and the Vancouver Electric Illuminating Company, binds the latter to supply 2,000 c. p. Thomson-Houston arc lights, at the rate of 44 cents per light for every night desired by the corporation. The agreement covers a period of five years, the corporation having the option at the end of one year to purchase the entire plant at a price to be fixed upon by arbitrators.—*Indus. World*.

New Westinghouse Plants.—During the month of September the Westinghouse Electric Company received the following orders for central station alternating current apparatus: Keokuk, Iowa, 750 lights; McMinnville, Ore., 500; Aspen, Colo., 750, increase; Vandalia, Ill., 750; Albany, Ore., 500; Victoria, Tex., 500; Lincoln, Ill., 750; Denver, Colo., 3,000, increase; New Bedford, Mass., 1,500, increase; Petaluma, Cal., 500; Bridgewater, Mass., 500; Salem, Ore. 750; Bellaire, O., 750; Houston, Tex., 750; Manchester, Ia., 500; Seattle, Wash., 750, increase; Ally. Co. Lt. Co., Pgh., Pa., 3,000, increase, Grafton, Dak., 500; Williamsport, Pa., 1,500; Amherst, Mass., 500, increase; Duluth, Minn., 750, increase; Helena, Mont., 1,500; Colorado Springs, Colo., 750, increase; Ballston Spa., N. Y., 750; Plattsburg, N. Y., 750; Tyrone, Pa., 750, increase; Kansas City, Kan., 750, increase; Marengo, Ia., 500; Media, Pa., 500, increase; Greensburg; P., 750, increase. Total, 26,750 16 c. p. lights capacity.

APPLICATIONS OF POWER.

Asheville, N. C.—The Asheville Sprague road is to be extended to Weaverville.

Dallas, Tex.—The North Dallas Circuit Railway Company propose to use electric power.

Charlotte, N. C.—An early change to electricity is expected on the Charlotte Street Railway.

Stevens Point, Wis., has granted an electric railway franchise and other electric privileges.

Salem, Mass.—It is said that the Naumkeag Street Railway Company's electric road will be 40 miles long and require 40 cars.

The Electric Street Railway Company, of Chicago, formed by E. Blix, W. Kron and W. A. Pulson, has a capital stock of $200,000.

Forest City, Pa.—The Hillside Coal and Iron Company will run an electric road in their Erie colliery, and light up the mine by electricity.

The Richmond Road.—Mr. E. H. Johnson, president of the Sprague Company, has published in the newspapers a very clear and pithy summary of the true conditions in regard to the Richmond road.

Seattle to Tacoma.—A long-distance electric road between Seattle and Tacoma, a distance of 30 miles, is proposed, the power to be furnished by four stations along the route. Mr. L. F. Thompson and others are said to be interested. The road would cost, it is said, $600,000.

Buffalo, N. Y.—The Buffalo Electric and Cable Street Railway Company, formed to operate street surface roads on about fifty miles of streets in the city of Buffalo, has filed a certificate of incorporation with the Secretary of State. The capital is $1,500,000. The incorporators are Daniel O'Day, Daniel N. Lockwood, James Amm, Gerhard Lang, Henry Altman, Thomas T. Ramsdell, James Adams, J. P. Dudley, and George F. Southard, of Buffalo, and William L. Elkins and Peter A. B. Widener, of Philadelphia.

The Ottumwa, Ia., Railway, Electric and Steam Company has a capital stock of $200,000, of which $75,000 is paid up. Wm. G. P. Daum is secretary of the company. The road has the Thomson-Houston overhead system, and the plant includes four Pullman cars, three miles and a half of standard gauge track, three 100 h. p. boilers and two 100 h. p. power Reynolds-Corliss engines. The system is to be extended and electric lighting is to be done. The company is also putting in the Holly system of steam-heating, as furnished by the American District Steam Company, of Lockport, N. Y.

The Troy & Lansingburg Railroad Company have recently gone into successful operation, their road being equipped with the Sprague system by Woodbridge & Turner, the electrical engineers of New York City. Eight cars have been equipped and some six miles of track. The power is furnished by two 80,000-watt Edison dynamos, each driven by a 150-h. p. engine, through a line of countershaft, so arranged that either engine can drive either generator, one machine alone being sufficient to furnish power for the entire present equipment. It is intended to extend the line at once through Waterford and Cohoes, and an order for additional cars has already been given. This affords evidence of the satisfaction with which the new system is regarded. It is expected also at an early date to extend the line through Troy itself. Mr. Clemenshaw is president of the road, Mr. J. B. Carr, vice-president, and Mr. J. Hagen, treasurer. Mr. C. H. Smith is superintendent, Mr. A. Crabbe, assistant superintendent, and Mr. E. D. Arnold, consulting engineer. The local papers speak highly of the operation of the road.

PERSONALS.

Dr. M. A. Starr describes in the November *Scribner* the effects of electricity upon the human body.

Mr. H. P. Brown has written to the *Evening Post* a letter, in which he claims that the Kemmler decision is a vindication of his testimony as a scientist and his honor as a man.

President E. R. Weeks, of the National Electric Light Association, was a welcome visitor at THE ELECTRICAL WORLD office last week. He reports that every indication goes to show that the annual meeting next February at Kansas City will be the largest and best winter session ever held by the body.

Mr. A. G. Davis, of the Viaduct Manufacturing Company of Baltimore, was in town last week. He states that his company are introducing a new five-call "answer back" box, patented by Paul Seiler, of San Francisco. It is simple in operation and handsome in appearance. The company are also pushing their new magneto fire alarm with marked success, it meeting the wants of small towns very happily.

Capt. J. W. Miller, president of the Providence & Stonington Steamship Company, proposes that steamers should have electric search lights for use in fog, so arranged that their beam is thrown vertically instead of horizontally. Such an outfit has been placed on the Sound steamer "Massachusetts," run from the incandescent plant, and Captain Miller is to bring the subject before the International Marine Conference at Washington.

MISCELLANEOUS NOTES.

To Kill Kemmler.—Mr. H. P. Brown has shipped from Sing Sing to Baltimore, for testing, the apparatus with which he proposes to kill Kemmler.

Another Subway Explosion occurred last week. This time it was at the corner of Cortlandt and Church streets. A wagon was passing and rose with the manhole cover. Nobody was hurt.

Blackwell's Island, N. Y.—The general superintendent thinks that a system of electric call bells should be put in; and it is recommended that $3,000 be spent on Ward's Island for the same purpose.

The Florence, Ala., Electrical Woodwork Supply Company has been formed at Florence by C. L. Revelle and Y. H. Hollingsworth, with a capital stock of $15,000, to manufacture pins, brackets, cleats, etc.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

Patterson, Gottfried & Hunter (Limited), 146-148 Centre street, carry a complete stock of brush copper, celluvert fibre oiled paper, hard rubber, rod and sheet brass, brass, copper and iron wire, self-hardening tool steel, set and cap screws, machine bolts, machine and wood screws, taps and dies, files and twist drills blowers and forges, machinery, tools and hardware, gear wheels, wood pulleys, shafting hangers and belting. General factory supplies.

Perforated Electric Belting.—

Testimonial.

WM. M. WORRELL,
ELECTRICAL ENGINEER AND CONTRACTOR,
PETERSBURG, Va., Sept. 30, 1889.

Messrs. Chas. A. Schieren & Co.

GENTLEMEN: In reply to your favor 27th, would say the perforated belts purchased from you for the *Concord Electric Light Company* are giving perfect satisfaction.

They drive two Edison dynamos, "*tandem*," the perforation preventing *air cushions*, which invariably occur with plain belts used this way.

I can't speak too highly of these belts, and hope to soon send you some nice orders. Yours very truly, WM. M. WORRELL.

Houston's Electrical Dictionary continues to receive the approval of electricians and the reading public in a remarkable manner. The critics also find much to admire in it. Last week, we quoted the commendation of the New York *Herald*. Below we give the opinion of the Philadelphia *Ledger:* "Probably no branch of modern knowledge is in so much need as electricity was of a competently prepared dictionary such as this of Professor Houston's. As the science of electricity has expanded, and as its applicability in other sciences, in manufactures, in the mechanic arts and in domestic uses have been developed within the last twenty years, adding to our resources for heating, lighting, motive power, surgery, medicine, processes in the laboratory and operations in the workshop, it has been obliged to express itself in a new vocabulary of its own—the terms of which were not always precisely understood, even by those somewhat familiar with the science, and in some degree expert in the arts to which the application of the science has given birth. It is to supply the want thus experienced that Professor Houston (who is the Houston of the Thomson-Houston Electric Light and other electric apparatus) has prepared his dictionary.

"The first observation to be made of the book (which is a handy, square duodecimo of more than 650 pages, of clear, open print, profusely illustrated), is that it is manifestly the product of large research and labor; that it is a pioneer work, the author having to blaze his own path all the way through; that as a pioneer work its possible defects, whatever they may prove to be, are to be scanned considerately by the critic's eye; that it fairly provides for the large field of usefulness it is designed to fill; and that its descriptions of instruments and apparatus, processes and theories, together with its engraved illustrations, are in the main not only good, but excellent.

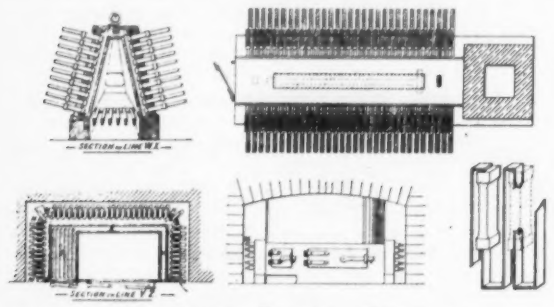
"We cannot speak so highly of all the *definitions*, for, while they are all concise, and by far the greater part of them are precise, there are some that are not clear or satisfactory and need revision. Still we are to remember that it is a pioneer book, a much-needed and useful work, and that the author contemplates utilizing the experience that comes from this essay in a perfected publication."

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED OCT. 8, 1889.

412,234. Sound Transmitter; Robie Blake, of Cornish, Me. Application filed March 29, 1889. The object of the invention is to provide a means whereby sound transmitted between two points through any medium, as by a current of electricity, by a column of air in a tube, or by means of a wire or cord drawn to a tension, or by other similar means, will be made more clearly audible and intelligible. This is accomplished by means of a radially movable diaphragm.

412,323. Method of Electrolytically Reducing Plates for Secondary Batteries; Stanley C. C. Currie, of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester City, N. J. Application filed April 19, 1889. The invention consists in increasing the effective area of the electrical conducting material of the plates during the reduction to a metallic state by causing the reduction to commence over the entire surface and gradually work its way through the plate in the line of cleavage or crystallization, thereby materially lessening the time required to reduce the plates, and giving as a product plates of a superior character for use as the electrodes of a secondary or storage battery. See illustration.

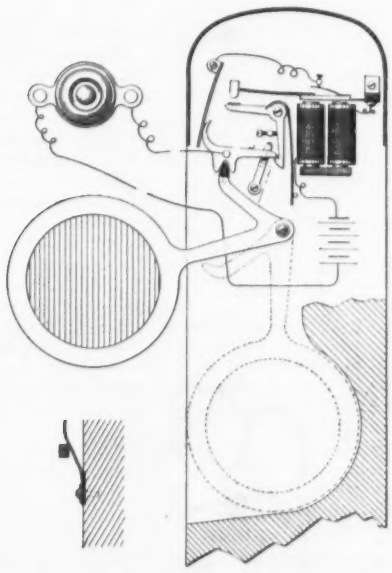


412,669.—Thermo-Electric Generator.

412,332. Electrically Controlled Speed-Governor Mechanism for Elevators; William P. Gibson, of New York, N. Y. Application filed Jan. 5, 1889. The object of the invention is to provide a speed-governing apparatus of improved construction for operating through electrical connections the valve mechanism of the elevator, and also the safety appliances of the same when from any cause the elevator car becomes unduly accelerated in its descent.

412,333. Electrically Controlled Valve Operating Mechanism for Elevators; William P. Gibson, of New York, N. Y. Application filed Jan. 5, 1889. The object of the invention is to provide a simple, reliable and economical apparatus by which the valve or other device for controlling the movements of the car can be operated by a circuit closer or closers in the car, and which shall at the same time provide means by which the valve or other device can be operated positively by means of mechanical connections, in case for any reason the electrical connections should fail to operate satisfactorily at any particular time.

412,345. Frame for Secondary Battery Plates; Walter F. Smith, of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester City, N. J. Application filed April 2, 1889. The invention consists in providing the plate composed of a series of small plates with a frame having a vertical lug and with an extension or auxiliary loops cast with or secured to the main portion of the surrounding frame of the series of plates for connecting the wire from the poles of a dynamo therewith, as well as with the lugs, if desired, and thereby enabling the requisite number of plates to be readily connected or coupled together, and with the poles of a dynamo for obtaining a good contact for the passage of the current of electricity from the dynamo for the reduction of the plates to a metallic state to form the electrodes of a secondary or storage battery.



412,530.—Electric Signal Controller.

(1) 412,346. Connector for Batteries; (2) 412,347. Connecting Device for Electric Batteries; Walter F. Smith, of Philadelphia, Pa., Assignor to the United Electric Improvement Company, of Gloucester City, N. J. Applications filed (1) April 19, 1889, (2) July 9, 1889. The invention relates to improvements in connecting devices for electric batteries composed of a divided male thimble, the female thimble being secured to the male thimble, so as to leave a space between the two thimbles for the introduction of mercury. The object of the invention is to deposit on the surface of the device a coating of conducting material—such as nickel—by electrolysis or otherwise, to prevent the mercury or other preferred material contained therein from destroying the device by amalgamation, whereby the electrical conductivity of the device is materially enhanced. A further object of the invention is to provide the connecting device between the female thimble and the strips or ribbons of the male thimble thereof with a gasket or gaskets composed of rubber or other material to prevent gases evolved during the operation of the battery from corroding the same.

(1) 412,349. Dynamo Electric Machine. (2) 412,350. Commutator. (3) 412,351. (4) 412,352. (5) 412,353. Dynamo Electric Machines; Charles F. Winkler, of Hoosick Falls, New York. Applications filed (1) and (2) January 26, 1889. (3) February 29, 1889. (4) April 23, 1889. (5) May 20, 1889. These patents relate to the construction and winding of the field magnets and armature of dynamo electric machines. They consist essentially of field magnets built up of alternate layers of wire and iron, the iron being in the shape of tubes and the wire wound on the outside thereof. The armature carries two separate circuits, one of which is utilized to energize the field magnets and the other to supply the external circuit. Another feature of the armature is the dispensing with an iron core in the armature. This is accomplished by an ingenious style of winding.

412,354. Electric Current Indicator; James J. Wood, of Brooklyn, N. Y. Application filed April 20, 1887. In an instrument for the purpose set forth, the combination, with a magnet, of a pivoted repellent armature having both pivoted and free ends in proximity to the same pole of the magnet, but with the pivoted end in a stronger magnetic field than the free end.

412,361. Ceiling Block for Incandescent Lamps; Sigmund Bergmann, of New York, N. Y. Application filed June 2, 1888. In an electric cut-out the combination, with a base piece having a central recess and binding posts and a cover adapted to close said recess of contact closers comprising resilient strips having connection with the binding post, and having their ends extended away from the wall of the recess, and provided with notches, retaining portions for the cover integral with the circuit closers extending outwardly adjacent to the walls of the recess at approximate right angles to the circuit closers, and having hook ends adapted to extend over the outer surface of the cover.

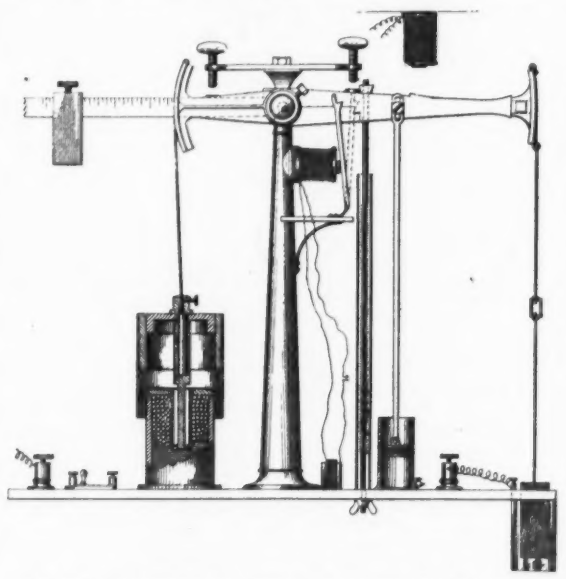
12,449. Artificial Resistance for Electric Circuits; Charles B. Askew, of Chicago, Ill. Application filed June 27, 1889. The combination, in a resistance device, of a refractory tube containing a refractory resistance material and inclosed in a refractory casing.

412,460. Circuit Closer for Signal Apparatus; George D. Bucton, of New Ipswich, N. H. Application filed July 23, 1886. In a system of train signaling, the combination, with an electric generator and conductors leading therefrom, of a circuit closer consisting of a frame having an insulated post, to which the terminals of the circuits are connected, the one terminal overlapping the other and the two fitting in a notched rod, said rod terminating in a ring or handle.

412,464. Electric Igniting Device for Lamps; Manuel Carranza, of Guatemala, Guatemala, and Jose M. Tinoco, of San Francisco, Cal. Application filed Oct. 11, 1888. In a lamp a rocking or swinging frame in an electric circuit and adapted to be moved forward and backward to close and open said circuit, a wire carried by the frame and adapted by the movement of the frame to be thrown into contact with the wick, and an electric circuit including the wire, whereby it is heated to incandescence, thereby lighting the wick.

412,476. Electric Conduit; John P. Cushing, of Beverly, Mass. Application filed July 8, 1889. The invention consists in the combination, with an electric conduit, of a main and return circulating pipe extended the length of the conduit to convey a heating medium to heat the conduit, a heater connected to the pipes and a pump to maintain a circulation through the heater and circulating pipes, whereby the electric conduit is heated.

412,520. Electric Motion Controller; Gustave S. Neu, of New York, N. Y. Application filed Aug. 28, 1888. In an electric machinery controller the combination with a gear coupler of a reacting device to operate the gear coupler, a catch to restrain



412,567.—Governor For Electric Generators.

the gear coupler, a vibratory hammer to trip the catch, and electro-magnetic devices to operate the hammer.

412,528. Electric Motor for Railway Cars; William M. McDougall, of East Orange, N. J. Application filed May 23, 1889. The object of the invention is to support the electric motor in a frame in the most firm and reliable manner, so that the frame itself may not become twisted or out of shape, and the frame is so supported by the car axles that the axles and wheels are free to accommodate inequalities in the track without either straining the electric motor frame or disturbing in any manner the proper relative positions of the parts of such motor.

412,530. Electric Signal Controller; Gustave S. Neu, of New York, N. Y. Application filed Aug. 28, 1888. In an electric signal controller, the combination, with a self-acting signal, of a catch to restrain the signal, a vibratory hammer to trip the catch, an electro-magnet and intermittent circuit breaker to vibrate the hammer, and a circuit controller included in the circuit with the electro-magnetic hammer vibrating devices, the said circuit controller being automatically closed by the setting of the signal for operation, and opened by the operation of the signal. See illus.

412,563. Electrical Door-Alarm; Daniel H. Streeper, of Norristown, Pa. Application filed July 19, 1889. The invention consists in the combination, with the knob socket, of a switch arm connected with the socket, so as to turn with it, and a contact plate inserted in the door in the path of the switch arm, the said knob socket and contact plate being in the circuit of a battery, including an alarm bell.

412,567. Governor for Electric Generators; Patrick J. Tracy, of Racine, Wis. The combination, with an electric generator, of an electro magnet and other electrically actuated devices arranged in parallel circuit, a balanced beam connected at one end to the generator, and an armature suspended from the other end of the beam to come in the attractive field of the electro-magnet, and be attracted in proportion as surplus energy manifests itself in said magnet, whereby the generation of the electric current is automatically regulated in case any one or all of the electrically actuated devices beyond the magnet loop are cut out of circuit. See illustrations.

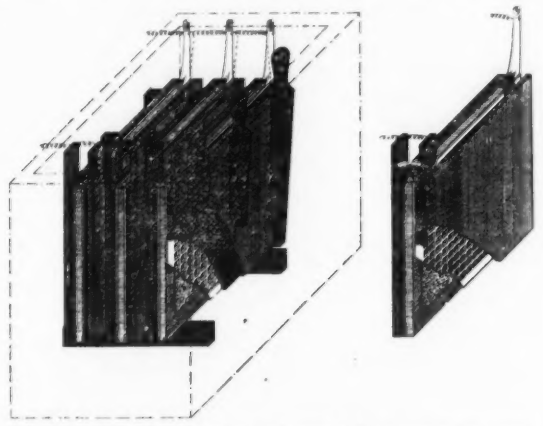
(1) 412,579. Microphone Transmitter; (2) 412,580. Telephone Station Apparatus; Bruno Abdank-Abakanowicz, of Paris, France, Assignor to the American Bell Telephone Company, of Boston, Mass. Application filed Feb. 20, 1889. Patented in France Feb. 28, 1888, and in Austria-Hungary April 16, 1888. The invention relates to combination telephone sets in which the various appliances are organized in a small compass, so as to make a compact and efficient telephonic outfit suitable for home use. The transmitter comprises a series of carbon discs standing on edge between an inclined plane of conducting material and a conducting-plate, preferably of carbon, carried by a vibratory diaphragm, the discs having necessarily a tendency to roll down the inclined plane, but being prevented from carrying the tendency into effect by their contact with the diaphragm plate, which holds them in place. The current passes through the discs and their respective front and rear contacts, and its strength is varied by variation in the resistance at points of contact when the diaphragm is varied by the voice of an operator.

412,599. Process of Electric Welding; Charles L. Coffin, of Detroit, Mich. Application filed April 24, 1889. The process of welding together two metal rods or bars, the same consisting in placing the articles to be welded in an electric circuit, closing the circuit, then breaking the circuit between the articles to be welded, whereby the voltaic arc is formed at the point of the weld, pressing the articles together and holding them permanently in contact after the ends or edges have reached a welding heat, and passing heating currents through the articles while so pressed and held until they are welded one to the other.

412,605. Electric Railway; Leo Daft, of Plainfield, N. J. Application filed June 11, 1888. The combination, with the trolley or brush bearing upward against a conducting wire, and its supporting and carrying connections, on top of the car, of a shifting or reversing mechanism therefor fitted within the car roof.

412,639. Secondary Battery; Farnham Maxwell Lyte, of London, County of Middlesex, Eng. Application filed Jan. 7, 1889. Patented in England July 13, 1883. The method of making a secondary battery element of electrode, consisting in first forming studs, prisms, bars, rods, or other suitable forms of active material, then casting or molding the supporting material around said active studs, prisms, bars, rods, or other forms in such manner as to hold them and expose a portion of their surface.

412,653. Mechanical Telephone; William Naylor, of Albion, Ill., Edward Craig, Administrator of said William Naylor, deceased. Application filed March 25, 1889. In a mechanical telephone, the combination of a wooden band, a metallic band, a diaphragm consisting of the combined layers of linen canvas, card

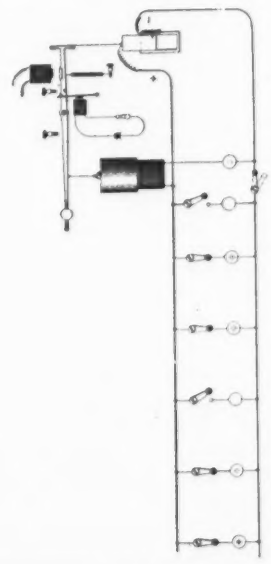


412,323.—Electrolytic Storage Battery Plates.

board, and linen paper glued together, and a backing consisting of the combined layers of card board and the linen paper glued together, the diaphragm being clamped on the wooden band by the metallic band.

412,666. Electrical Railway Conduit and Current Plow; Jesse W. Reno, of Denver, Col. Application filed April 29, 1889. In a conduit for electric railways, the combination, with the girder rail of a hollow metal casing composed of a top and bottom section joined back to back, the bottom section being secured to the base of said rail, and the top section forming with the rail the plow slot.

412,669. Thermo-Electric Generator; William S. De L. Roberts, and James Smith Mollison, of Sydney, N. S. W. Application filed Feb. 9, 1889. The invention consists of a stove or furnace which is surrounded by an air-tight chamber, the outer walls of which are composed of any suitable non-combustible insulating material, preferably a mixture of fire-clay and asbestos. The couples are so inserted into the insulating wall that for a portion of their length they shall project into the hot air chamber. The heat in this chamber is regulated by a pyro safety-valve fixed in any convenient position in the upper part of the chamber. All risk of overheating the chamber will thus be



412,567.—Governor for Electric Generators.

avoided and a uniform heat imparted to the couples that project within the hot-air chamber. See illustration.

412,700. Regulator for Dynamo-Electric Machines; William H. Elkins, of Cambridge, Mass., Assignor of two-thirds, by direct and mesne assignments, to Arthur B. Griggs, of Boston Mass., and Polly Craig, of De Funiak Springs, Fla. Application filed Jan. 18, 1889. A modification of the three-brush regulator.

PATENT EXPIRED OCT. 1, 1889.

131,878. Improvement in Galvanic Batteries; Henry Highton, of Putney, England. The use of a substance in the positive part of the battery, which will precipitate injurious soluble metallic salts.

PATENT EXPIRED OCT. 8, 1889.

132,118. Improvement in Machine for Uniting the Soles to Uppers of Boots and Shoes; Jacob B. Tirrell, of Charlestown, Assignor to Gordon McKay, Trustee, of Boston, Mass. In combination with gripping devices that grip and drive the wire, and with a metal or metal faced support, a magnetic coil and armature, and mechanism connecting the armature with gripping devices, the contact of the point of the driven or entering wire with the metal face of the work support causing the circuit to be closed, the armature to be moved, and the grip to be released.

PATENT EXPIRED OCT. 15, 1889.

132,278. Improvement in Electrical Temperature Signals; Webster Gillette, of Ypsilanti, Mich. The invention relates to a device which the inventor designates an electro pyrometric annunciating signal apparatus; the object is to indicate an undue excess of heat in grain bins, buildings, journal boxes, malt rooms, etc. It embraces an iron tube filled with mercury which by expansion operates a relay and bell.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times Building, N. Y.